USING THE HEALTH BELIEF MODEL TO INVESTIGATE PARENT PERCEPTIONS OF LEAD TESTING: IMPLICATIONS FOR HEALTH COMMUNICATION RESEARCH AND PRACTICE

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DEDICATION

This thesis is dedicated to my parents, Kevin and Becky, who always believe in me and my desire to strive for more. Thank you for loving me and finding value in my education.

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I would first like to thank my committee for the support and guidance they offered throughout this research. This project would not have been possible without them. Nor would it be possible without the special guidance of my advisor, Dr. Katharine J. Head, who spent countless hours helping me understand what it means to conduct research and solving my crises.

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USING THE HEALTH BELIEF MODEL TO INVESTIGATE

PARENT PERCEPTIONS OF LEAD TESTING:

IMPLICATIONS FOR HEALTH COMMUNICATION RESEARCH AND PRACTICE

Children are at increased risk for harmful lead exposure due to their behavior and the increased percentage of lead absorption. While lead levels and the possible adverse health effects vary by age and level absorbed, the medical field agrees that lead is a persistent public health issue of the first order. Importantly, Hoosier children are at an increased risk for possible negative side effects because of the small percentage of children who are being tested; despite the AAP's recommendation. The Health Belief Model (HBM) provided a strong and appropriate framework for guiding this formative research about parents' perceptions of blood lead testing. This study aimed to answer two research questions based on HBM concepts and utilized both quantitative and qualitative methods to help answer them. Using snowball and convenience sampling, 14 Hoosier parents were recruited to participate in this study during the spring of 2020. Parents were recruitment from four counties across the state with known high rates of lead and/or low rates of blood lead testing among babies and small children. The findings from this study yield broad suggestions for future work within the field of communication research and specific suggestions for applied communication campaign research and clinical interventions within the state of Indiana. This study suggests we still have a long way to go as a state in addressing the dangers of lead toxicity and increasing regular testing among Hoosier children.

Katharine J. Head, PhD, Chair

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CHAPTER ONE: THE PROBLEM OF LEAD TESTING

In 1786, Benjamin Franklin composed a letter to Benjamin Vaughan, a British Politian and medical doctor, expressing his concern about the potential harmful effects of lead, which he had learned about after a visit to a Parisian hospital in which almost all the sick patients worked in trades related to lead.

In the last paragraph of his letter, he implores Vaughn to concern himself with the knowledge of the "mischievous effect of lead" and questions whether others will ever take the concern of lead seriously. After almost 250 years since Franklin discussed the harmful effects of lead and expressed his concern, the United States, and Indiana in particular, have made some strides in our understanding of this public health threat and have developed methods to test and treat the threat of lead toxicity. However, there is still much work that must be done. For "how long a useful Truth may be known, and exist," without constant or complete mitigation, is still of great question (Franklin, B., 1997).

Lead – The Ongoing Public Health Threat

Leading medical organizations are consistently in agreement that there is no known safe level of lead in blood. The American Academy of Pediatrics (AAP) has recognized that while there is no threshold for the toxic effects of lead, blood lead concentrations below 10 µg/dL, historically a widely accepted threshold for lead levels, may impair cognition (AAP, 2016). Lead is a highly toxic, poisonous metal despite how one may come in contact with the substance. Whether inhaled or ingested, lead can lead to detrimental health effects. The Centers for Disease Control and Prevention (CDC, 2020) acknowledge that lead poisoning can lead to many well-documented adverse effects; including, "damage to the brain and nervous system, slowed growth and

development, learning and behavior problems, and hearing and speech problems" (paragraph 2).

Lead is potent, invisible, and can damage all vital organs and body systems, including the central nervous system, causing developmental and behavioral disorders (Miracle, 2017). While the threat of lead toxicity remains throughout one's life, the risk of serious complications is even higher in fetuses and children (Miracle, 2017). Detectable levels of lead in children's blood have been associated with several negative impacts, including decreased cognitive function, behavioral disorders, slowed physical development, and financial burden (ISDH, 2020). Increased lead levels have also been linked to decreased reading scores (Aizer et al., 2018), sociologic and biologic delinquency (Olympio et al., 2009), decreased bone and muscle growth (Bhowmik et al., 2012), nervous system damage (Bhowmik et al., 2012), developmental delays (Bhowmik et al., 2012), and other negative medical, social, and cognitive delays and/or problems. In sum, lead toxicity is a serious public health threat, especially for children during their most vital years of development. In the next few sections, I will further explore lead and lead toxicity in our society, describe how health campaigns have worked to elevate public knowledge on the topic, and explain what methods we have for preventing and addressing lead toxicity in today's society.

Defining Lead Toxicity

Despite Franklin trying to warn people about lead poisoning in the 1700s, it received scant attention until the 1900s when medical and public health practitioners realized how serious a threat it was. For much of the 20th century, lead poisoning stood as "the most prevalent and serious disease of environmental origin for young children in the

United States" (Silbergeld, 1997, p. 187). By the mid-1920s lead poisoning and its causes were accurately described by medical doctors Holt and Howland (Holt & Howland, 1926); however, it was over five decades later, in the 1970s, when comprehensive and effective actions were taken to prevent and eliminate this disease (Silbergeld, 1997). Silbergeld states that "lead poisoning is an entirely preventable disease, induced [only] by exposures to lead" (1997, p. 189). Since the 1920s, the definition of lead poisoning, specifically the understanding the exposure level at which clinical toxicity occurs, has changed drastically. Over the past 100 years, medical and public health communities have shifted from assuming "only high-dose, overtly encephalopathic exposures were significant to the recognition that very low doses, without clear symptom presentation, are associated with measurable neurotoxicity" (Silbergeld, 1997, p. 189). This shifting and evolving definition of lead toxicity occurred through research devoted to better understanding sources of lead exposure, how human bodies absorb lead, and the effects lead has on the human body. Each of these will be discussed below.

Sources of Lead

Children and adults may come in frequent contact with lead through a variety of sources and without even knowing it. These sources include, but are not limited to, lead-based paint (in older homes built before 1978); corroding pipes in failing or older infrastructure; imported vitamins, minerals, herbal supplements, medication, and toys; home remedies; imported candy; older stained glass; some antiques, especially those with chipping paint; soil; pollution (mostly in urban areas); copper pipes; brass fixtures; and dust in areas of construction, manufacturing, and mining (Miracle, 2017). There are also several state-specific lead threats in the state of Indiana. Lingering lead pollution in the

air from the urbanized and industrialized area along the southwestern shore of Lake Michigan (Harrison & Winchester, 1971; Waterhouse & Smith, 2015), contamination of bluegill in two Indiana lakes due to industrially contamination (Atchison et al., 1997), and lead-containing sediments at Indiana Dunes National Lakeshore (Perkins et al., 2000) have all contributed to an increased threat of high blood lead levels in Hoosiers. However, for Hoosier children, the most common lead exposure occurs through lead-based paint (ISDH Lead and Healthy Homes Division (2018). Sources of lead contribute greatly to how lead is absorbed in the body. Below are examples of a lead absorption in the body.

Absorption of Lead

There are two primary pathways of absorption of lead into the human body, inhalation and ingestion. A third, less known, and less significant absorption pathway is dermal contact (e.g., having one's skin come in contact with lead containing materials; ATSDR, 2019). It is worthy to note that regardless of absorption pathway, the potentially harmful health effects are the same (Williams et al, 2000). Children are at a greater risk of lead poisoning due to a common childhood habit – placing items in their mouth. Sayre et al. explains this stating, children "have ingested the lead over a period of months by actually picking at the peeling paint and eating small chips—a habit called pica" (Sayre et al., 1974, p. 167). Chisolm (1971) hypothesized a triad of common factors that contribute to a child's risk of lead toxicity: (1) "a dilapidated house, (2) a child with pica, and (3) parents with inadequate sources (emotional, intellectual, informational, and/or economic)" (p. 21).

While the potential adverse health effects are the same, risk for lead toxicity through these forms of absorption is not. Lead exposure from inhalation is responsible for the greatest proportion of lead toxicity cases for occupationally exposed persons, while the average person is at greater risk for lead toxicity through ingestion (Williams et al., 2000). Similar to the differences in inhalation and ingestion risk, children and adults are at vastly difference risk, as well. Children can absorb up to 50% of the ingested lead (Alexander et al., 1973), while adults often only absorb no more than 10% (Heard et al., 1982). Risk of lead exposure and risk for absorption varies greatly depending on profession and age, as stated above. Children are at the most risk of elevated blood lead levels due to the higher percentage of potentially absorbed lead and the normal childhood behavior of putting items in their months. For these reasons, the population in most need of being tested is children.

Lead Effects in the Human Body

Lead can affect several of the body's systems. Elevated blood lead levels can prevent blood cells from carrying oxygen, cause kidney failure, prevent calcium release into blood by acting as a calcium substitute (which can lead to several negative effects in the brain (Goldstein, 1990)), reduce fertility (in males and females), increase risk of premature birth or miscarriage, cause anemia, and lead to permanent damage of the brain and nervous system (EPA, 2004). Possible reactions to various lead levels are shown in Table 1. Again, it is important to note that there is no known safe level of lead in the body; however, higher levels of exposure are associated with more serious and long-term effects (Leech et al., 2016, p. 151).

Table 1:

Blood Lead Levels and Associated Possible Health Effects in Children

Blood Lead Level	Possible Health Effects
10 mcg/dL	Slight loss in IQ; hearing and growth problems
20 mcg/dL	Moderate loss in IQ; hyperactivity; poor attention span; difficulty learning; language and speech problems; slower reflexes
40 mcg/dL	Poor bone and muscle development; clumsiness; lack of coordination; early anemia; decreased red blood cells; tiredness; drowsiness
50 mcg/dL	Stomach aches and cramps; anemia; destruction of red blood cells; brain damage
100 mcg/dL	Swelling of brain; seizures; coma; death

Note. This information was taken from the Environmental Protection Agency's (EPA, 2004) EPA Model Lead-Based Paint Abatement Worker Training Course.

Importantly, the definition of lead poisoning in the medical community has evolved over the last century, each time lowering the assumed safe level of lead humans can have in their bodies (Silbergeld, 1997). While medical and public health communities develop more enhanced understanding of the harmful effects of lead toxicity, it is also important that this information is accurately and clearly communicated to the public.

Similar to helpful minerals such as iron, calcium, and zinc – lead is distributed throughout a person's body, wreaking havoc on one's entire body and its systems (Bhowmik et al., 2012). Several studies indicated that while there is no known safe level of lead in blood, severe negative cognitive deficits have been linked to a little as 5 mcg/dL (Leech et al., 2016; Miracle, 2017). Standard protocol indicates that 10 mcg/dL is considered elevated (Lanphear et al., 2000).

Reduction in Lead Poisoning and Lead Prevention Campaigns

Great strides have been made in reducing blood lead levels since the 1970s and much of that is due to public health and health communication efforts. Since 1971, the U.S. has maintained a decline in population-level lead exposure (Dignam et al., 2019). The first nationally representation study of lead levels found that in persons aged 1 to 74 years, 78% had blood lead levels of 10 ug/dL or higher; when sampling children aged 1 to 5, that number rose to 88% (Dignam et al., 2019). A comparison of 1976 to 1991 blood lead levels found decreased levels; in persons 1 to 74 years, levels dropped from 12.8 in 1976 to 2.8 ug/dL in 1991 (Pirkle et al., 1994). Similar reductions in mean levels were found in children aged 1 to 5 years, with levels in 1976 at 13.7 and levels in 1991 dropping to 3.2 ug/dL (Pirkle et al., 1994).

These reductions are due in part to lead control measures the U.S. has implemented, mostly through screening and addressing sources of lead in the community. Screening recommendations for children has varied over the past several decades. In 1970, screening recommendations were only for children in older homes. In 1985, screening recommendations moved to all children, regardless of the age of their home; however, in 1997, screening became optional and only recommended for children in high-risk neighborhoods and specific populations (Dignam et al., 2019).

Screening Guidelines and Protocol

Children are screened for elevated blood lead levels through a simple blood test where blood is taken from a finger prick or vein (Mayo Clinic, 2019a). The AAP recommends either following state or local health department recommendations, or, if there are no state/local recommendations, having all children between the ages of one to

two years tested (Mayo Clinic, 2019a). Indiana recommends that all children are tested at ages one and two, and ages three to six if they have never been tested before (ISDH, 2020c). ISDH also recommends that providers ask a series of questions at each well child visit. If the answers to any of the following questions is *yes* or *unknown*, a blood test is necessary (ISDH, 2020c):

1. Is your child living in or regularly visiting, or has your child lived in or regularly visited, a house or child-care center built before 1978?
2. Does your child have a sibling or playmate who has or who has had an elevated blood lead level?
3. Does your child frequently come in contact with an adult who works in an industry or has a hobby using lead (battery factory, steel smelter, stained glass)?
4. Is your child a recent immigrant or a member of a minority group?
5. Does anyone in your family use ethnic or folk remedies or cosmetics?

If a child's blood test results in an elevated blood lead level, removing the source of lead is the first priority. Generally low levels of lead can usually be reduced by avoiding exposure; however, treatment for higher levels (generally over 45 ug/dL) may result in chelation therapy (a medication that binds to lead and is then excreted in urine) (Mayo Clinic, 2019a).

Lead Testing Campaign History

The achievements in screening and follow-up care since 1970 are indeed great. Despite this, **t**he ongoing lead poisoning incident in Flint, Michigan shows that issues in regard to lead are not simply an issue of the past. A 2020 study found that 14% of babies born to mothers in Flint, Michigan had cord blood lead levels greater than or equal to 1

ug/dL, as compared to 2% of Detroit, Michigan newborns (Hanna-Attisha et al., 2020). Showing that, similar to other public health issues, there are serious health disparities that exist among some communities. The U.S. government also pledged reduced mean blood lead levels among all children to 1.6 ug/dL or below in its Healthy People 2020 objectives through increased screening and other mitigation strategies (Dignam et al., 2019). This goal was achieved between 2009 and 2010; however, significant disparities still exist based on income, location, race, and ethnicity (Dignam et al., 2019). Achieving high levels of screening is an essential part of addressing lead toxicity, but screening rates remain low. In 2017 the CDC reported that only 18.7% of children in the United States under the age of 72 months (six years) had been tested for elevated blood lead levels (CDC, 2019). Targeted campaigns and public health initiatives have worked to address these disparities, with varying success.

The United States has taken steps in the past to prevent the incidence of lead toxicity in children. Throughout 1971, emphasis on prevention through early detect of elevated blood lead levels began to grow. Understanding "undue absorption of lead" became a priority (Ettinger et al., 2019). In 1978, the US Consumer Product Safety Commission (CPSC) began the process of restricting the amount of allowable lead in paint and other products, including, lead based gasoline and plumbing (AAP, 2016). While progress was made, continued efforts in understanding and preventing undue absorption of lead are still needed.

Recent Campaigns

New Hampshire, New York, Virginia, Hawaii, Maine, Minnesota, Michigan, and Connecticut (Gettens and Drouin, 2019; Myers, 2018; Dooley, 2006; Felton et al., 2019;

Zabel et al., 2008; McLaughlin et al., 2004) are all among states that have pushed for increased testing of elevated blood lead levels through health campaigns and/or public policy changes. For example, Hartford, Connecticut's "Getting the Lead Out" campaign consisted of a multifaceted public health campaign which involved an educational video, displaying children's art at the state capital, educational displays at local hardware stores, newspaper advertisements, billboards, milk carton campaigns, signs on city buses and bus shelters, signs on municipal sanitation trucks, orange juice carton campaigns, and a postmark campaign which read, "Let's give every child a lead safe home" (McLauglin et al., 2004, p. 2). At the conclusion of the campaign, over 45% of respondents reported taking steps to prevent lead poisoning in their day to day lives and recall of campaign messages ranged from 21.5 to 62.6% (McLaughlin et al., 2004). Through this campaign, the city has taken steps to continue to disseminate information about lead poisoning and other public health issues through educational materials, particularly the sanitation truck advertisements and the postmarks, in their community.

On the other hand - New Hampshire has had one of the most successful strategies to increase blood lead testing and decrease lead toxicity rates by targeting healthcare providers and clinics. New Hampshire's five-part strategy included increasing provider awareness of blood lead point-of-care (POC) testing, implementing a medical education program, creating and distributing medical "quick guides" reference materials, developing parent reminder for blood lead tests at the age of one year and the age of two years, and increasing the availability of POC testing equipment (Gettens & Drouin, 2019, p. S32-S33). Within six months of implementation, the number of blood lead tests

reported increase between 2-fold and 81-fold at pediatric medical sites in three of highest-risk New Hampshire communities.

There is strong evidence that public health inventions and health communication campaigns work to educate parents of young children, create opportunities for communication about blood lead testing with providers, and provide medical personal with the tools to ensure timely, widespread testing for all children. However, similar to other public health issues like vaccination, smoking, and obesity, reducing the risk of lead poisoning through education and screening may need to involve both public health promotion strategies *and* clinical interventions.

Lead in Indiana

In 2017, the Indiana State Department of Health (ISDH) published a Childhood Lead Surveillance in Indiana report. In this report, the number of Hoosier children tested in 2017 represented about 11% of the children under the age of seven, based on the U.S. Census population estimate for 2017 (ISDH, 2017). While the number of children tested for elevated levels increased 23% (from 56,438 children to 65,318 children) between 2016 and 2017, it is important to note that a majority of children are still not being tested (ISDH, 2017).

In Indiana, over 58% of all homes were built prior to 1980 (U.S. Census Bureau, 2017). This is significant because prior to the 1978 ban on lead in residential paint, lead-based paint was commonly used for painting the interior and exterior of homes (CDC, 2019). The CDC acknowledges that in the United States, "approximately 24 million housing units have significant lead-based paint hazards including deteriorated paint and

lead-contaminated house dust. About 4 million of these are home to young children" (CDC, 2019, para. 3).

The ISDH 2018 childhood lead surveillance report detailed lead testing within certain counties (ISDH Lead and Healthy Homes Division, 2018). The report identifies that certain counties may be more at risk and/or exhibiting lower levels of lead screening, suggesting that not only do we need to do some state-level work, but there are disparities that exist within the state that are worthy of attention.

Summary

Children are at increased risk for harmful lead exposure due to their behavior and the increased percentage of lead absorption. While lead levels and the possible adverse health effects vary by age and level absorbed, the medical field agrees that lead is a persistent public health issue of the first order (Leech et al, 2016).

Importantly, Hoosier children are at an increased risk for possible negative side effects because of the small percentage of children who are being tested; despite the AAP's recommendation. Federal law mandates that children presently on Medicaid must be tested for elevated blood lead levels (ISDH, 2017); however, the state of Indiana has no requirement for blood lead testing Hoosier children not enrolled in Medicare. This leaves lead testing optional for many of Indiana's children.

In order to address low lead testing behaviors in Indiana, research is needed to explore the knowledge and awareness that Hoosier parents have about blood lead testing, what types of communication they already engage in about blood lead testing, and how future communication about this topic should be presented. This work can serve as formative research to inform much needed public health and patient-provider

communication about lead toxicity and testing in Indiana. In order to fully explore this topic, it is important to utilize a strong foundation of previous health behavior research. The next chapter will explore and describe how the use of a particular theoretical model, the Health Belief Model, has guided previous work and will guide this project.

CHAPTER TWO: THEORETICAL FRAMEWORK

Chapter two discusses the importance of using a strong theoretical framework to guide formative research and eventual intervention or campaign development for effective health behavior change. Importantly, when used in tandem, formative research like the current study and the use of theory, provide the conceptual foundation for a successful health campaign (Maddock et al., 2008). A theory is defined as a "set of interrelated concepts, definitions, and propositions that present a systematic view of events or situations by specifying relations among variables in order to explain and predict events or situations" (Glanz et al., 2008, p. 26). Theories help us to understand, explain, and predict phenomena in the world. Communication researchers have long understood that theory is used as both a thing that can be studied and also serves a purpose in communication campaigns. Fishbein and Cappella (2006) concluded that "when properly applied, theories …allow us to identify critical beliefs underlying a person's intention to perform (or not perform) any given behavior" (p. 514), which can then guide message development. In this chapter, I will review the history, components, and uses for one particular theory, the Health Belief Model (HBM). This theoretical framework not only guided the planning, but also the implementation and analysis, of this study.

Health Belief Model History

Social science research is often completed to discern why people behave in certain ways, particularly regarding their health. One theoretical model that is useful in understanding health behavior took root when researchers were trying to understand why some people performed certain health behaviors and why others did not. This theoretical

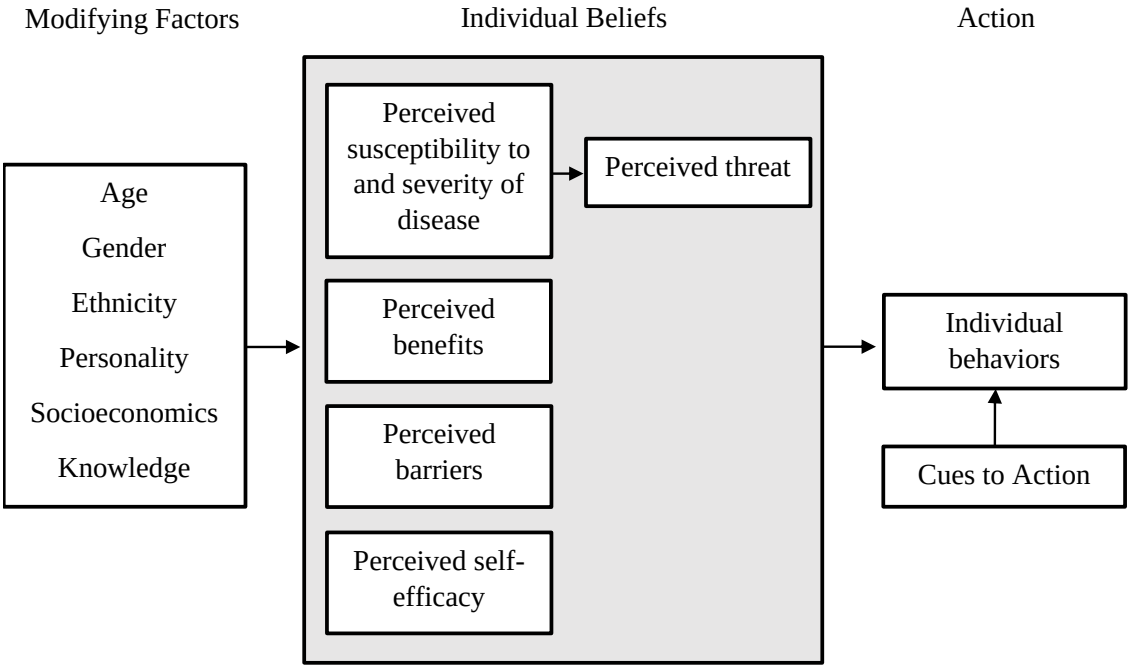
framework is the Health Belief Model (HBM). In the 1950s, social psychologists from the U.S. Public Health Service sought to better understand why the general public failed to participate in programs aimed at early prevention or detection of disease (Hochbaum, 1958; Rosenstock, 1960, 1974). Specifically, these researchers (Janz et al., 2002) were trying to understand why individuals were opposed to engaging in preventative health behaviors like cervical cancer screening and polio vaccination (Rosenstock, 1974). Rosenstock used Kasl and Cobb's definition of health behavior, stating that, "health behavior is any activity undertaken by a person who believes himself to be healthy for the purpose of preventing disease or detecting disease in an asymptomatic stage" (Rosenstock, 1974, p. 354). This differs greatly with illness behavior, which is defined as, "any activity undertaken by a person who feels ill, for the purpose of defining the state of his health and of discovering suitable remedy" (Rosenstock 1974, p. 354). Lead testing falls promptly under the category of a health behavior. As discussed in chapter one, lead toxicity is rarely presented with specific symptoms or signs until severe damage has happened to the body and its systems. Children who undergo blood lead testing often do so only as a preventative test or to detect the level of lead toxicity.

The first major components of the HBM included perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action (Janz et al., 2002). The model was then extended in the 1960s and 70s to better understand symptom response in individuals (Kirscht, 1974) and how a diagnosed illness, requiring a medical regimen, affected behavior (Becker, 1974). In 1977, Bandura suggested the addition of the component of self-efficacy and, in 1988, Rosenstock, Strecher, and Becker added

self-efficacy to the HBM, completing the model that is used today (Champion and Skinner, 2008, p.49). See Figure 1.

Figure 1:

The Health Belief Model: Components and Linkage



Note. Figure 1 is from Champion and Skinner (2008, p. 49).

Conceptual Underpinnings of the HBM

The HBM suggests that individuals are:

> "most likely to engage in preventive behaviors if the following criteria are met: (1) they believe they are susceptible to the disease (perceived susceptibility), (2) they believe the illness could have serious negative consequences (perceived severity), and (3) they believe the benefits to screening outweigh the barriers (perceived benefits and barriers to screening)" (VanDyke & Shell, 2017, p. 351).

The HBM is a theoretical model within health behavior research which is used to examine "change and maintenance of health-related behaviors and as a guiding framework for health behavior interventions" (Champion and Skinner, 2008, p. 45).

Constructs of the HBM

The HBM contains several components that predict "why people will take action to prevent, to screen for, or to control illness conditions" (Champion and Skinner, 2008, p. 46). The theoretical model postulates that behavior is affected by six constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. When individuals acknowledge they are susceptible to a condition, understand and believe this condition may have potentially serious consequences, trust that an available treatment or course of action would be beneficial in reducing susceptibility or severity, and believe that the benefit(s) outweigh any barrier(s), they are more likely to engage in risk reduction measures (Champion and Skinner, 2008, p. 47). Researchers have used the HBM to investigate how parents participate in sexual education conversations (Brock and Beazley, 1995), why parents delay or refuse vaccination (Smith et al., 2011), motivations to enroll in a parental skills program (Spoth, 1995), bicycle helmet usage among their children (Scheider, 1998), and how parents use the internet to seek out information about the Human Papilloma Virus vaccination (McRee, 2012). The HBM provides an appropriate framework for examining lead testing behaviors. For example, if a parent or guardian perceives that their child is at some risk for elevated blood lead levels or they perceive the barriers to testing to be low and the benefits of testing high, they will, in-turn, allow or even seek out testing. Each component of the HBM will be further defined in the next few sections.

Perceived Susceptibility

The first component of the HBM, perceived susceptibility, refers to the perception that an illness, disease, or condition is likely to happen (Janz et al., 2002). Measuring

perceived susceptibility occurs in many ways. Vollrath et al. (1999) examined perceived susceptibility using a 5-point Likert scale, where young women ranked risky health behaviors and their own perceived susceptibility of the risk in comparison with other women their age. The quantitative Likert-type scale ranged from "much below average" to "much above average" (Vollrath et al., 1999). In another study about preschool aged preventative dental visits, the researchers utilized qualitative focus groups where parents were able to discuss, "What [would] happen if your child (under 6) does not have a checkup?" (Askelson et al., 2014). Both quantitative and qualitative assessments of susceptibility are valuable when analyzing this construct. In regard to lead testing, a parent must believe that there is a possibility of their child having elevated blood lead levels, and that those elevated lead levels have negative health effects, before they may be motivated to have blood lead testing for this child.

Perceived Severity

According to the HBM, perceived severity takes one's belief of the seriousness of a medical condition or illness into account (Janz et al., 2002). Severity is categorized as both the medical/clinical consequences (e.g., pain, disability, or death) and the social consequences (e.g., effects of work conditions, family life, or social relations) of having a particular condition or illness (Champion and Skinner, 2008). Findings of a 2014 study regarding oral health and teeth brushing habits suggested that perceived severity of tooth decay played an important role in individuals adopting a "desirable health behavior" (teeth brushing) (Kasmaei et al., 2014). The study asked participants to rank statements such as, "Tooth decay will cause me bad breath smell" and "Tooth decay will make me

look bad when I am laughing" on a Likert-type scale. In the case of lead testing, parents must believe and be aware that the consequences of lead toxicity in children are severe.

When combined, perceived susceptibility and severity are labeled as perceived threat (Champion and Skinner, 2008, p. 47). In a meta-analysis examining studies which used the HBM to examine health behaviors, perceived threat was found as the strongest predictor of a whether an individual enacts a health behavior (Carpenter, 2010).

Perceived Benefits

The third component of the HBM refers to one's belief in the effectiveness of risk-reducing actions (Janz et al., 2002). Even if an individual believes there is a health threat (they are susceptible and the condition could be severe), one's belief about the benefits of taking action will influence potential behavior change. A 2005 study about lead testing used only two constructs of the HBM – perceived benefits and self-efficacy (Bland et al., 2005). The study used a Likert-type scale to assess parent's perception that blood lead testing would help prevent or keep their child from having a high lead level. Downing-Matibag and Geisinger (2009) used interviews as a method to better understand sexual risk-taking behavior among college students. Similar to Downing- Matibad and Geisinger, the current study uses a similar method of interviews to understand perceived benefits parents have about preventative health behaviors, specifically lead testing. The current study also includes one quantitative question about perceived benefits in the survey. In the case of lead testing, and similar to the Bland et al. study, parents must believe that lead testing has benefits in protecting their child.

Perceived Barriers

Perceived barriers are described by Champion and Skinner as the potential for negative side effects, unpleasant feelings, inconvenience, or time consumption when enacting a behavior (2008). These potential for negative outcomes could be obstructions or impediments that occur when pursuing medical interventions (Champion & Skinner, 2008; Janz et al., 2002). Barriers to certain behaviors can include a broad array of factors and these factors can be different for each individual. In a 2002 study, for example, researchers found that barriers to self-management of diabetes included lack of knowledge and understanding, lack of individualized care, feelings of helplessness, limited resources, inconvenience of cost, and difficulty remembering to perform certain actions (Nagelkerk et al., 2006). While diabetes management and lead testing are dissimilar in terms of a management behavior versus preventative behavior, in order to perform a behavior, similar barriers must be addressed in lead testing.

When decisions about whether to pursue a medical recommendation are taking place, perceived barriers and perceived benefits become part of a mostly subconscious cost-benefit analysis (Champion and Skinner, 2008, p. 47). Rosenstock states that, "combined levels of susceptibility and severity provide the energy or force to act and the perception of benefits (minus barriers) provide a preferred path of action" (1974, p. 332).

When combined, perceived benefits and barriers can be referred to as outcome expectations. Outcome expectations are defined as "beliefs about the likelihood of various outcomes that might result from the behaviors that a person might choose to perform, and the perceived value of those outcomes" (McAlister et al., 2008, p. 172). In

the case of lead testing, parents would need to expect that lead testing would give them an outcome such as valuable information about their child's health.

Cues to Action

Several early adaptations of the HBM include the concept of cues that promote an action. Hochbaum (1958) supposed that readiness to take action could only be possible if other factors, or cues, existed that promoted said action. These cues include bodily events, such as the emergence of symptoms, communication, and environmental events, such as media publicity (Champion and Skinner, 2008). Cues to action was previously referred to as motivation; however, these cues are difficult to study and can be "as fleeting as a sneeze or the barely conscious perception of a poster" (Champion and Skinner, 2008, p. 49). Within health communication research and practice, cues to action include any of the strategies that are part of a campaign or intervention that promote readiness to participate in an action (Champion and Skinner, 2008). Importantly, cues to action are the only explicit communication variable within the HBM framework. Champion and Skinner (2008) note that cues to action "are one component of the HBM often missing from research … [they] have greater influence on behavior in situations where perceived threat and benefits are high and perceived barriers are low" (p. 62). Cues to actions for this study are conceptualized as communication about lead testing that occurs in everyday talk with friends and family, conversations that occur in providers offices with nurses, doctors, and other clinic staff, and/or physical materials present in the environment. These materials, for example, could be pamphlets, billboard, posters, advertises, or any other physically tangible material parents read, listen to, or watch. Understanding what cues to action already exist for parents of young children will help

provide recommendations for further research and/or lead testing campaigns to either promote cues already in use or facilitate in the making of new cues (communication and/or campaigns).

Self-Efficacy

Self-efficacy is defined as the confidence or "the conviction that one can successfully execute the behavior required to produce the outcomes" (Bandura, 1977). Self-efficacy was never explicitly used during the early stages of the HBM because the original model was developed to explain preventive health actions that were seen as relatively easy to perform (e.g., a one-time vaccination), or not complex behaviors (Champion and Skinner, 2008). For behavior change to occur, people must, "feel themselves competent (self-efficacious) to overcome perceived barriers to take action" (Champion and Skinner, 2008, p. 50). Self-efficacy can be assessed in a variety of ways. For example, Bland et al. (2005) analyzed this construct by asking participants to rank "how easy or hard would it be for you to [behavior]?" from 1 (very easy) to 4 (very hard). Ingram, Cabral, and Hay (2013) analyzed focus group and interview transcriptions about parent's self-efficacy regarding childhood respiratory tract infections and found that experience with other children and a need for reassurance to be factors affecting parent's perceived self-efficacy. In terms of lead testing, self-efficacy may be an important variable to consider, even though lead testing is a relatively easy behavior to perform (e.g., a simple blood stick done at a healthcare provider's office).

Other Potential Components

The HBM also posits several potential modifying factors, or variables, that may play a role in health behavior. For instance, age, gender, race and ethnicity, personality,

socioeconomic status, and knowledge level have the possibility to influence one's perceptions of a health threat (Champion and Skinner, 2008). It is believed that sociodemographic factors, especially education level, may have an indirect effect on behavior changes by influences perceived susceptibility, severity, benefits, and barriers (Champion and Skinner, 2008, p. 50). These modifying factors could potentially play a role in understanding why parents may perceived lead testing differently.

Health Behavior Research Using the HBM

The HBM is a widely accepted and used framework within health behavior research and has proven itself useful for guiding research in a number of contexts, including breast cancer screening (VanDyke & Shell, 2017), cervical cancer screening among HIV positive women (Solomon et al., 2019), parental vaccination hesitancy (Smith et al., 2011), AIDS-prevention (Champion and Skinner, 2008), vaccination uptake (Smith et al., 2011), contraception (Brown et al., 2011), and asthma management (Bursch et al., 2009), among the others discussed throughout this chapter. While the full model has not previously been used in lead testing research, the flexibility of the model and its use with similar health behaviors (e.g., cancer screening, vaccination) suggests it is a good fit for work on understanding lead testing. Like many health behavior theories, the model can guide both formative research and campaign development.

Formative Research

The HBM has been used as a framework for formative research for several different topics. In 2006, Silk used the model to research the public's perception of breast cancer risk. This study found that fewer perceived barriers predicted greater mammography screening; however, perceived susceptibility, severity, and benefits were

not predictors of the behavior (mammography screening for breast cancer (Silk et al., 2006). The model has been used to identify perceptions of cigarettes in college students which then informed future health communication campaigns (Case et al., 2016). In 2011, the HBM guided research regarding weight loss programs in Appalachian Kentucky (Webber & Quintiliani, 2011). The HBM has also informed formative work about influenza and pneumococcal vaccination in older adults (Ho et al., 2017). Each of these studies contributes to a larger body of work regarding preventative health screenings and behaviors. The HBM has established itself as a powerful tool in preventative health research.

Formative research using the HBM is widely used to help explain preventative health behaviors, including, child drowning prevention (Denehy et al., 2016), HIV prevention (Fraze et al., 2009, Orrego et al., 2018), and hearing loss prevention (Patel et al., 2001; Stephenson & Stephenson., 2011). The HBM is a valuable model that helps to explain and predict health behaviors and elucidates important constructs to consider when conducting formative research to understand a health behavior. The previous research used the HBM shows the valuable role the theory can serve to guide formative research on health behavior, and specifically prevention behaviors. For the current study, the HBM is used to understand what constructs are important to parents in order to develop future blood lead testing campaign material.

HBM as a Guide to Intervention Design

The HBM has also successfully served as a guide for developing effective health interventions or campaigns. From is conception, the HBM sought to understand why the public did not engage in a behavior and give insight in how to remedy and promote the

behavior in question. Smoking and tobacco cessation campaigns (Cohen et al.,2007; White et al., 2003), road safety campaigns (Adamos & Nathanail, 2016), diabetes education campaigns (Gallivan et al., 2007), and healthy eating campaigns (Deshpande et al., 2009) are some of the HBM-guided campaigns that focus on promotion of a behavior that will prevent progress of a disease or prevent manifestation of a health problem, such as healthy eating promoting cardiac health.

The HBM addresses the motivators a person or group of people have when deciding to perform a certain behavior; for example, blood lead testing. Addressing the constructs of the HBM that parents are most concerned with, will inform future campaign design by allowing researchers to understand the communication and message needs of parents of young children in regard to blood lead testing. In order to do this, formative work is needed to understand the constructs of the HBM that are most concerning to parents of Hoosier children.

Beyond designing campaigns, the HBM can also be used to predict health behaviors. Importantly, the high numbers of studies using the HBM has led to several meta-analyses documenting the ability of the HBM to predict various health behaviors (Carpenter, 2010; Harrison et al., 1992; Janz & Becker, 1984; Zimmerman & Vernberg, 1994). The most current meta-analysis, completed in 2010, concluded that regarding preventative behaviors, benefits and barriers "seem to predict behavior better" and that benefits and barriers "emerged as the strongest predictors" of any behavior (Carpenter, 2010, p. 17-19).

The Current Study

Given the problem of low lead testing in Indiana and the increased risk for lead toxicity faced by Hoosier children, the current study aims to better understand how parents perceive the behavior of lead testing. The HBM provides a strong and appropriate framework for guiding formative research into parents' perceptions of blood lead testing, which can inform future intervention design as well. The HBM is a valuable tool that assisted in understanding parent perceptions of lead toxicity, and the current study specifically addresses the following two research questions:

RQ1: How do Indiana parents perceive the threat (susceptibility and severity) of blood toxicity?

RQ2: What do Indiana parents report in terms of perceived facilitators and perceived benefits, cues to action, and self-efficacy regarding the behavior of blood lead testing?

CHAPTER THREE: METHODS

This study utilized both quantitative and qualitative methods, through the use of surveys and interviews, respectively. Participants were recruited during the spring of 2020, using snowball and convenience sampling, from several counties across the state with known high rates of lead and/or low rates of blood lead testing among babies and small children. Original research plans were altered due to the onset of Coronavirus Disease-19 (COVID-19) pandemic; see Appendix A for a discussion of those changes. Prior to participant recruitment, this protocol received IRB approval as an exempt study through the University of Indiana's Institutional Review Board (Protocol Number 2003680333).

Method

Participants and Recruitment

Participant Inclusion and Exclusion Criteria

Participant inclusion for this study was composed of the following criteria: must be a parent or guardian of any age, live in Floyd, Hamilton, Marion, or Vanderburgh, Indiana counties, have at least one child five years of age or younger, child must have a primary care provider that the child sees regularly for well-child visits, speak and read English, have internet access to complete an online survey, have access to a phone to complete the telephone interview, agree to an online survey, and agree to participate in a telephone interview lasting up to 30 minutes.

Participants were excluded if they did not have a child that was five years of age or younger. This helped guarantee that information they potentially received about lead testing when their child was 6 to 36 months was relevant enough to the information that

parents could potentially hear from providers now. It also ensures that this health topic is currently or relatively recently a relevant health topic to these parents of young children.

Counties

Parents were recruited from four counties throughout the state of Indiana. After consulting with the division director for Lead and Healthy Homes at the ISDH (Paul Krievins, personal communication, November 18, 2020) and evaluating the data present in the risk map and the 2018 Lead Report (ISDH Lead and Healthy Homes Division, 2018), the following counties were chosen: Floyd, Hamilton, Marion, and Vanderburgh. These counties were chosen because they fulfilled at least one of the following two criteria:

(1) the Lead Census Tract Risks Map shows elevated risk for lead exposure (ISDH, 2020) and/or

(2) (2) the 2018 Lead Report showed poor rates of lead testing based on county population (ISDH Lead and Healthy Homes Division, 2018).

Lead risk factors include percentage of homes built pre-1940, homes built 1940-1949, children living in poverty under age 6, and percentage of the Black population. percentage of testing for each county was derived by dividing the number of children tested in 2018 (ISDH Lead and Healthy Homes Division, 2018) by the corresponding county population (U.S. Census Bureau, 2018). **Table 2** provides an overview of county criteria.

Table 2:

Description of Criteria for Selecting High Risk Indiana Counties in the Current Study

Note. This table show the classification of lead risk and the percentage of tests administered in each of the four Indiana Counties chosen for this study. This information was taken from the ISHD website (ISDH Lead and Healthy Homes Division, 2018; ISDH 2020) and the U.S. Census Bureau (2018).

County	Classification on Lead Risk Map Data	Number of Tests Given/County Population
Floyd	Low to Highest Risk	1.23%
Hamilton	Lowest to Low Risk	0.72%
Marion	Moderate to Highest Risk	1.28%
Vanderburgh	Low to Highest Risk	1.06%

Recruitment Strategies

Parents were recruited from the four Indiana counties described above. I used both convenience and snowball sampling during the recruitment process, which occurred mostly through social media (Facebook). I posted a social media post on my personal Facebook asking friends and family to help in the recruitment process; many of my social media contacts shared the post on their pages as well. The social media post can be found in Appendix B. Parents self-identified themselves for the study by responding to the social media post or by having mutual friends "tag" them on my post. If a person was tagged in the post, I sent a direct message to them introducing myself and asking for their participation. I also sent direct messages to friends and family in each of the four counties, asking for assistance recruiting eligible parents in their respective counties. Two weeks after my initial post on social media, I reshared my post, continuing to seek help from family and friends in each of the four counties.

Because data collection began while I was also recruiting more participants, it allowed me to also ask current participants for assistance in recruitment. Several parents were able to provide contact information for their family and friends, resulting in the successful recruitment of additional participants. Recruitment began on April 11, 2020

and was closed on May 15, 2020. The goal for each county was to interview four to five parents per county, for a total of up to 20 parents. Despite this goal, recruitment during the pandemic was more difficult than excepted, especially given that my population (parents with young children) were facing unexpected childcare and e-learning situations at home and may not be able to complete an interview. In the end, a total of 14 parents participated in the study, four parents from Floyd County, two parents from Hamilton County, five parents from Marion County, and three parents from Vanderburgh County. It is important to note that in one instance, a father and mother completed the survey and interview together and their participation was counted as one person. This couple was from Floyd County; they completed the survey as one "unit" and provided answers together during the interview portion.

Initial Contact and Email Correspondence

Participants expressed interest by emailing me directly or by responding to the social media post. I responded to each interested participant and began the process of validating the inclusion criteria and beginning the survey portion of the study. The participants received an email with a unique participant ID number and a link to the online study; they were asked to complete the survey and respond with a time that worked best for a telephone interview. The email correspondence script can be found in Appendix C.

Each participant ID began with the first letter of the county the participant resided in. For example, the first participant recruited was given the participant ID of MCP31, MCP indicating "Marion County Participant," 3 further clarified the county identifier (e.g., Marion County was county 3), and 1 indicated the order of participants interviewed

in that county (e.g., this parent would have been the first interviewed from Marion County). Participant IDs were designed so that no parent participant would share too close of an ID, but also allowed me to easily and clearly keep track of participants.

Procedures

Using a mixed methods approach, to better understand what parents perceptions of lead testing, I collected survey data and conducted interviews with parents who resided in one of four selected counties (Floyd, Hamilton, Marion, and Vanderburgh), with the purpose of gathering a variety of different perspectives from parents who were living in counties with known lead risks or low testing rates.

Survey Completion

Once a participant was confirmed for participation, they were emailed a link to complete a short online survey. The questionnaire was administered through Qualtrics. The email that they received included a unique participant ID that they input during the survey so that I could link their survey responses and interview data. The survey was designed to take no more than 10-15 minutes to complete. Completion time, flow, and wording were all pretested by several friends and family members. Actual survey completion time ranged from just over three minutes to 18 minutes.

The online survey is included in Appendix D. The survey was developed by myself after reviewing previous literature on lead testing and the HBM (Champion & Skinner, 2008; Janz et al., 2002; Mehta & Binns, 1998), consultation from my advisor, and consultation from the ISDH Lead and Healthy Homes Division.

The survey included demographic questions, including race, marital status, the age of parents, the age of the child within zero to five years of age, and county of

residence. The survey also included questions about previous blood lead testing of their children aged six to 36 months of age (e.g., behavior). Once parents answered whether their child's blood lead levels had been tested, they were directed to one of two "select all that apply questions." Each of the possible answer in these two questions corresponded with constructs from the HBM. If parents selected "yes" (their child was tested) they were asked to select responses from the following choices; my child is/was exposed and susceptible to lead, elevated blood lead levels have dangerous and severe symptoms, I understood the benefits, I had easy access to the test, it came at my child's doctor's recommendation, I felt like I could make an informed decision and felt confident in my decision, and/or other. Parents who selected "no" (their child was not tested) were directed to a question with the opposite of these responses, for example, I had inadequate access to the test, or I felt like I did not know enough about the test to have it performed. Consistent with the HBM, the survey also included items assessing perceived susceptibility, perceived severity, perceived benefits and perceived barriers to the behavior, cues to action, and self-efficacy.

During conversations with Mr. Krievins, he noted that he ISDH has requested all terminology used for programs regarding lead be changed from "lead poisoning" to either "lead toxicity" or "elevated blood lead levels" due to the highly emotional connotation of the word 'poisoning.' While these terms all mean the same thing scientifically, I was hesitant to use only "lead toxicity," as some of our interview participants may not understand the meaning of this term. It is important to understand how people use and make meaning from words or phrases, especially when this understanding may help inform future health campaign messaging. A multiple-choice question was added in order

to better identify what phrases Hoosier parents associated as "meaning the same thing as lead poisoning." The multiple-choice question included three correct and three incorrect answers so that I would be able to evaluate how parents make meaning from each of these terms or phrases.

The last section of the online survey included questions from the Chicago Lead Knowledge Test (Mehta & Binns, 1998). In 1998, The Chicago Lead Knowledge Test was published by Mehta and Binns for the Pediatric Practice Research Group. The authors used the knowledge test, provided in the Appendix, to better understand parental knowledge about lead toxicity and lead prevention. It was especially important to include this particular knowledge scale because it was lead specific, had been used in prior research, and could be used as a formative research tool to better understand the knowledge parents currently have so that I may be able better understand what their knowledge needs might be.

Telephone Interview

Once the survey was complete, parents set up a day and time that best worked with their schedules for a telephone interview. The interviews were projected to take no more than 30 minutes of their time; actual interview times ranged from 13 to 39 minutes, with an average of 25 minutes. At the start of the telephone interview, parents verbally consented and agreed to an audio recording of the interview. I then used the interview guide to lead the discussion with each parent. The interview guide was comprised of eight sections; general health concerns about young children, susceptibility, severity, benefits, barriers, cues, to action, self-efficacy, and general messaging/conclusion. The

interview guide was designed using the health belief model framework and is included in Appendix E.

Using the HBM framework (Champion and Skinner, 2008), I wrote at least two questions that appealed to each of the HBM constructs. These questions were mostly open ended to prompt dialogue with each participant. After careful consideration of each question in the interview guide and IRB approval, I began practicing interviews with a family member. I interviewed her several times, instructing her to answer the questions while taking on a variety of different personalities. She was able to emulate a parent whose comfort with interviewing was low, whose knowledge about lead was low, whose knowledge about lead was high, and a parent who needed further assistance clarifying questions. Each practice interview allowed me to become more comfortable and confident with the questions, the cadence of the interview, and being able to provide summative feedback back to participants. Since I do not have children of my own, sharing the common thread of parenthood is not how I built rapport with participants. Instead, I built rapport with parents by sharing a sincere reassurance that all answers were worthy, regardless of how knowledgeable parents felt about blood lead testing. When parents answered questions, I was also able to quickly discern the core meaning of their answer and repeat it back to them in a summative manner. This was a way for me to check understanding and allowed parents to add to other thoughts that they may have forgotten to add to their initial answer. I had many parents express gratitude in this practice. During the interviews, I was able to assess potential psychological distress of discussing child health threats by paying special attention to tone of voice. It was somewhat hard to truly know if a parent was distressed because of the nature of the

telephone interviews. To combat this, I frequently reassured parents that there were no wrong answers, especially when they became uneasy about questions, particularly about signs and symptoms of elevated blood lead testing. Seldomly, parents asked about the severity of lead toxicity in their county. I was able to ease any potential fear by reassuring parents that debriefing material would be emailed after the interview and instructing them to consult with their provider for specific risk questions regarding their individual families. Overall, the interview process was fairly easy and I enjoyed conducting the interviews. I found that most parents shared similar answers for most questions, but made sure to take notes during the interview process for any interesting and surprising answers; after each interview, I added to these notes and completed an informal analytic memo for each participant. This helped during the transcription and analysis process as I was able to make special note of any unique answers and observations I made at the time of the interview. The analysis process is described more fully below.

Debriefing Material and Incentives

At the completion of the interview, parents were compensated for their time with a digital $20 gift card which was emailed to them. Due to the small amount of time parents were asked to devote to the survey and interview and the voluntary nature of the project, the IRB determined that a $20 gift card did not provide any undue influence for subject participation because of the minimal amount of the incentive. Parents also received debriefing material that I provided via email. These digital handouts included information from the CDC about lead testing and information on how to contact their local providers with any further questions. The debriefing material can be found in Appendix F.

Data Analysis

Interviews

To analyze the 14 interviews, I first transcribed each interview. Typing the transcriptions myself, I was able to better familiarize myself with the data and brainstorm potential codes that were emerging. After all interviews were transcribed, I spent several weeks reading, analyzing, and evaluating potential codes found within the data. Specifically, I followed the thematic analysis method outlined by Braun and Clarke (Braun & Clarke, 2006; Braun, Clarke, & Terry, 2012). Braun and Clarke state that thematic analysis is "a method for identifying, analyzing, and reporting patterns (themes) within data" (Braun and Clarke, 2006, p. 6). There are several phases of thematic analysis that Braun and Clarke outline, including, (1) familiarizing yourself with the data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report. This method has been used in similar studies examining health perceptions and health prevention behaviors, including lead testing (Ekenga et al., 2018), mother to child HIV transmission (Haffejee et al., 2016), and melanoma risk (Smit et al., 2017).

A majority of the time was spent in phases one and two where I read the entire transcription of each interview several times before generating codes. While reading the transcriptions, I used several different color highlighters and pens. I also used a large poster board to jot down any potential codes or ideas that I was starting to see throughout the different transcriptions. The notes that I kept during the interview process (i.e., my analytic memos and observations) were especially helpful during this part of the analysis process. I found that looking at the notes I had taken during the interviews helped me to

see potential patterns that were emerging within the data. Once all of the data was coded, I collated all codes into a single Word Documents with all coded phrases under them. There were several codes that were split in two, combined to make one, or renamed throughout this process. I met with my advisor several times during this process to gather feedback and guidance. Once the data had been exhaustively coded, the 12 final codes where collated into the four following general themes: parent perceptions of childhood health, communication occurrence, the medical field is reliable, and barriers exist that make lead testing unrelatable. Subthemes are also included and explored in the Findings chapter. Participants were given pseudonyms that corresponded with their gender and the first initial of the county they resided in. For example, I used Frank from Floyd county and Vivienne from Vanderburgh county. I then selected exemplar excerpts of the codes to be included as examples in the Findings in Chapter Four.

Survey

Survey data was analyzed utilizing the tools in Qualtrics and downloading the data to a Microsoft Excel document. Once data was in Excel, I pulled means and descriptive data for each variable. I was able to use Qualtrics to pull mean scores for each question of the knowledge scale portion of the survey. Qualtrics did not allow scoring for each individual participant's knowledge score; however, access to their individual answers was available. I individually scored each participant by hand, triple checking each participant's score during three separate occasions for accuracy. Each question the participant answered correctly was worth one point, points for each participant were totaled and put in a separate Excel document. I then calculated the mean score for each county and the total mean score using Excel.

A Mixed Methods Approach

A mixed method approach, an approach that utilizes the advantages of both qualitative and quantitative methods, allows for myriad benefits: increased validity and confidence in the results of a study, cultivation of ideas for future research, and assistance with knowledge creation (McKim, 2017). Mixed methods research has been studied and results show that "graduate students view mixed methods passages as having rigorous methods, a newer history, and providing a deeper meaning of the phenomenon" (McKim, 2017, p. 202).

In sum, the quantitative data tells helps us see the "what" of a research question. However, moving beyond the quantitative data, the qualitative data allows us to hear, in participants' own voices, some of the reasons (or the "why") for the quantitative answers. In the following chapter, theme one will show how the two approaches are used together, giving insight to both parents' knowledge scores from the Chicago Lead Knowledge Survey and their emotional reactions to what a lack of knowledge about lead means to them. Themes two through four rely exclusively on the qualitative data.

Summary of Chapter Three

Chapter three included details about the methods and procedures used in this study, the steps I engaged in with each participant, and how I evaluated the data. In the following chapter, results of the online survey and the thematic analysis will be revealed.

CHAPTER FOUR: RESULTS

Chapter four includes both qualitative and quantitative results from the survey and interview data collected. There are several themes that will be examined using excerpts from the interview data, including: (1) parent perceptions of childhood health, (2) barriers exist that make lead toxicity unrelatable, (3) communication occurrence, and (4) the medical field as a reliable source. This chapter will first delve into the quantitative data collected from the surveys before it transitions to discussion of the four broad themes. Theme one, parent perceptions of childhood health, includes both quantitative and qualitative data to better understanding the knowledge parents have about lead. Themes two, three, and four relies only on qualitative data from the parent interviews.

Qualitative and Quantitative Results

Parent Survey – Descriptive Information of Sample

There were 14 parents of zero to five-year-old children who completed both the survey and interview that followed. All respondents currently resided in one of the four Indiana counties described in Chapter Three. Respondents had a mean age of 31.86 years (SD = 5.2). Ninety-three percent were Caucasian, and 93% were married. Other characteristics of respondents are listed in **Table 3**.

Table 3:

Sample Descriptives

Variable	n(%) or mean (SD)
Demographic Characteristics	
Age	31.86 (5.2)
Race/Ethnicity	
Caucasian	13 (92.9%)
Asian	1 (7.1%)
Marital Status	
Married	13 (92.9%)

Member of an unmarried couple	1 (7.1%)
Child Age	2.3 (1.2) [a]
City, State of residence when child was 6-36 months of age	
Carmel, IN	2 (14.30%) [b]
Evansville, IN	3 (21.40%)
Borden, IN	1 (7.15%)
Indianapolis, IN	5 (35.70%)
New Albany, IN	1 (7.15%)
Georgetown, IN	1 (7.15%)
Lanesville, IN	1 (7.15%)
Current County of Residence	
Hamilton County	2 (14.3%)
Floyd County	4 (28.6%)
Marion County	5 (35.7%)
Vanderburgh County	3 (21.4%)
Healthcare Characteristics	
Received blood lead test between the ages of 6 and 36 months	
Yes	7 (50%) [c]
No	6 (42.9%)
Child is not yet 6 months	1 (7.1%)
Plan to receive blood lead test when eligible	
Yes	1 (100%)

Note. [a] Children less than 6 months were given a value of 0.5, while children 6-12 months were given a value of 0.75. [b] Percentages were taken to the 100th decimal point for this question only. [c] Later, three parents who had answered yes expressed that they were unsure if their child had actually been tested. This is explained further in the paragraph below.

When asked if their child had been tested for elevated blood lead levels, 50% of parents answered "yes." However, during the interview process, two parents expressed that upon further consideration, they were not sure if their child had, indeed, been tested for elevated blood lead levels and when directed to the next question, "Select all the reasons your family tested for elevated blood lead levels", three parents answered that they were not sure if their child was specifically tested for elevated blood lead levels. Matching interview answers with participant ID numbers uncovered that three total

parents are unsure if their child had been tested, resulting in only four parents who were certain their child had been tested. This means that of 14 parents in this study, only 28.6% could be certain their child had received this recommended test.

After answering "yes," "no," or "my child is not yet 6 months of age," when asked if their child received a blood lead test between the ages of 6 and 36 months, parents were directed to one of two questions regarding their motivations to test or not to test their child. Reasons parents tested for elevated blood lead levels was only answered by parents who answered "yes" that their child has been tested for elevated blood lead levels (n=7), this question allowed parents to select all answers that applied and also included an "other" textbox. "Other" answers included, "I actually don't think my kid has been tested but I can't go back and change my answer," "I am not sure if it was ever tested," "Blood work was not lead testing specific nor did we as parents request it to be routine. It was routine," and "I assume it's a good thing to have tested?"

Reasons parents did not test child for elevated blood lead levels was only answered by parents who answered "no," that their child has not been tested for elevated blood lead levels (n=6), this questions also allowed parents to select all answers that apply and included an "other" textbox, as well. Testing motivations can be found in **Table 4**. There were no "other" answers as to why parents did not test their child for elevated blood lead levels.

Table 4:

Testing Motivators

Reasons parents tested child for elevated blood lead levels (n=7)	# of Responses
Child was exposed and susceptible to lead	0
Elevated blood lead levels have dangerous and severe symptoms	2

Understood the benefits	2
Easy access to testing	1
Doctor recommended it	3
Could make an informed decision and feel confident in it	1
Other:	4
Reasons parents did not test child for elevated blood lead levels (n=6)	
Child was not exposed nor susceptible to lead	3
Elevated blood lead levels are not dangerous, and symptoms are not severe	0
Do not understand any possible benefit	0
Inadequate access to the test	0
Doctor never recommended it	5
Did not know enough about the test to have it performed	1
Did not have custody of child during ages of 6-36 months	0
Other:	0

Themes

The remainder of this chapter is dedicated to exploring the four themes that emerged from the qualitative interview data. However, theme one includes both qualitative and quantitative data. Themes two through four are exclusively qualitative data. Each theme will be introduced and excerpts from the parent interviews will be used to further describe the themes.

Theme One: Parent Perceptions of Childhood Health

The first theme discusses parent's perception of childhood health and potential health risks for children. Ideas that lead is not at the forefront of parent's minds are evident. Parents indirectly express lead as not a concern and express a lack knowledge about how it is contracted, the symptoms, the actual test, and general understanding. Parents also had an emotional reaction when describing the lack of knowledge they had about lead testing. While lead testing was not a high concern to parents, they did express concern for other health areas, including developmental progression, which can be

affected by elevated blood lead levels. There appears to be a clear lack of knowledge about lead toxicity and how it is linked to overall childhood health.

Lack of Knowledge. During the interview process parents answered an array of questions about blood lead testing and how it relates to their child and family. Many parents expressed a clear lack of knowledge about lead in general and lack of knowledge specifically about how it is contracted, the symptoms of elevated levels, and how the test is physically administered.

Harriet divulged, "I don't know the answers and specifics, like what's the consequence? Consequences of the poisoning and of the levels and the, the symptoms. Yeah. I'm not aware of those." Meagan offered her limited knowledge about lead testing, expressing, "I always just you know, thought about them just ingesting paint or something, but I don't know if you can get it from other sources like that too."

Parents self-disclosure of the lack of knowledge they had about lead testing is supported by the survey they completed prior to the interview. Parents completed the 24-question Chicago Lead Knowledge Test at the end of the online survey. The survey is divided in to four sections. Prevention and nutrition questions were less often answered correctly than questions about general information and lead exposure. Questions and Reponses of the Chicago Lead Knowledge Test can be found in **Table 5.**

Table 5:

Chicago Lead Knowledge Survey

	Responses, n (%)		
Question	Correct	Incorrect	I Don't Know
General Information			
1. Lead paint chips can be poisonous when eaten. (T)	12 (85.7%)	0 (0%)	2 (14.3%)

2. High lead in the body can affect a child's ability to learn. (T)	12 (85.7%)	0 (0%)	2 (14.3%)
3. Most children have symptoms right away if they have an elevated blood lead level. (F)	8 (57.1%)	0 (0%)	6 (42.9%)
4. Apartment owners are required to tell renters about known lead-containing paint in the apartment when a lease is signed. (T)	7 (50%)	0 (0%)	7 (50%)
5. A child's highest blood lead level generally occurs around 5 years of age. (F)	0 (0%)	0 (0%)	14 (100%)
Exposure			
6. Lead paint is more likely to be found in newer homes, rather than in older homes. (F)	12 (85.7%)	0 (0%)	2 (14.3%)
7. Living in a building during renovation/remolding can increase a child's exposure to lead. (T)	11 (78.6%)	0 (0%)	3 (21.4%)
8. One way for children to get lead poisoned is by having lead dust on their hands and then putting their hands in their mouth. (T)	12 (85.7%)	0 (0%)	2 (14.3%)
9. A child can become lead poisoned during exposure to lead-containing dust. (T)	11 (78.6%)	0 (0%)	3 (21.4%)
10. Some pottery imported from Mexico or other countries is not safe to use in cooking or for eating because it contains lead. (T)	3 (21.4%)	1 (7.1%)	10 (71.4%)
11. Parents who work with lead at their jobs can bring lead home on their clothes. (T)	7 (50%)	3 (21.4%)	4 (28.6%)
12. The lead a pregnant woman takes into her body	7 (50%)	1 (7.1%)	6 (42.9%)

can be transferred to the unborn baby. (T)			
13. Lead in soil cannot harm children. (F)	7 (50%)	0 (0%)	7 (50%)
14. Most cases of childhood lead poisoning are caused by drinking water that contains lead. (F)	2 (14.3%)	2 (14.3%)	10 (71.4%)
15. Most children get lead poisoning by breathing lead rather than by eating or swallowing lead. (F)	1 (7.1%)	1 (7.1%)	12 (85.7%)
16. Some herbal or traditional home remedies contain lead. (T)	2 (14.3%)	0 (0%)	12 (85.7%)
Prevention			
17. Washing a child's hands often helps prevent lead poisoning. (T)	8 (57.1%)	2 (14.3%)	4 (28.6%)
18. Warm tap water usually contains less lead than cold tap water. (F)	3 (21.4%)	0 (0%)	11 (78.6%)
19. Lead in water can be removed by boiling the water. (F)	4 (28.6%)	1 (7.1%)	9 (64.3%)
20. Cleaning a home with soap and water decreases the lead in the home more than dusting or sweeping. (T)	4 (28.6%)	2 (14.3%)	8 (57.1%)
Nutrition			
21. The human body needs a small amount of lead for good nutrition. (F)	2 (14.3%)	5 (35.7%)	7 (50%)
22. Less lead is taken up by the body if the child eats a balanced diet, without too many fatty foods. (T)	4 (28.6%)	1 (7.1%)	9 (64.3%)
23. A diet with a good amount of iron-containing food will help decrease a child's chance of becoming lead poisoned. (T)	2 (14.3%)	2 (14.3%)	10 (71.4%)
24. A diet with enough calcium helps prevent lead poisoning. (T)	2 (14.3%)	1 (7.1%)	11 (78.6%)

Note. The correct answer choice (T=True, F=False) is provided next to each individual item.

Parents, on average, answered 10.21 (SD, 4.25) of the possible 24 questions correctly. One point was given for each correct answer; no points were given for "I don't know" or incorrect responses. **Table 6** shows the mean score for each county. It is important to note that one participant in Hamilton County skipped they entire knowledge survey. Their responses were considered to be missing data.

Table 6:

Overall Chicago Lead Knowledge Scores

	Mean Score (SD)
All Respondents	10.8 (1.17)
Floyd County	13 (3.27)
Hamilton County	10 (0[a])
Marion County	9.8 (1.30)
Vanderburgh County	11 (5.29)

Note. Scores could potential range from 0 being the lowest to 24 being the highest. [a] Since one of the two participants did not answer any part of the knowledge scale, only one parent's response was able to be counted for Hamilton County.

Emotional Reaction to Lack of Knowledge. While parents expressed a lack of cognitive knowledge, they also showed an emotional reaction to this absence of knowledge as they became more and more aware of how much they didn't know. Miriam described lead testing stating,

> "When I saw this survey and stuff, I was kind of shocked just because, I read a pregnancy book, front to back… And I get packets of information from my doctor, every checkup we go to. And I read through all of it really diligently, you know, to make sure I'm doing everything right and then even in the hospital. And I was shocked. I don't recall reading anything about lead, being told anything about it or what to watch out for, anything. So I don't feel like I'm very well educated on it, honestly."

Another parent, Victoria, added to the emotional feeling of being uneducated, acknowledging that, "You just, sometimes, when you feel uneducated about it, it creates a new kind of just like a worry." While some parents hinted at the lack of information

leading to lack of knowledge, others expressed a clear deficiency when answering the interview questions, Hazel admitted, “There is an answer. I just don’t know what it is. I have no idea.”

There are Other, More Concerning Aspects of Health. Multiple parents expressed concern for the health of their children; however, these concerns were focused mainly on nutrition, physical development, vaccination concerns, and even respiratory concerns, such as asthma. Parents did not express lead toxicity as a major health concern at the forefront of their mind when asked directly. Florence replied, “Mine’s more, I guess behavioral, not necessarily health concerns… Gross motor, fine motor and those types of things, were worrisome, their vision, their hearing. Those would be some of the bigger [concerns].”

Two mothers, Morgan and Marilyn, echoed other parents’ concerns with nutrition. Morgan described, “I think the biggest concerns that I have are just like good nutrition… a well-balanced diet and that he gets enough sleep, [those] are the biggest two that I always am thinking about.”

The other mother, Marilyn, detailed, “I guess just making sure that she’s getting the proper nutrition … And probably like physical growth, like her hand eye coordination, walking, crawling, all these new abilities that she’s learning how to do.”

Missing from each of the interviews was the connection that elevated blood lead levels have on many of the health concerns parents expressed. As mentioned previously, elevated blood lead levels can lead to an array of issues, including sociological and biological delinquency and developmental delays. Lack of knowledge about elevated blood lead levels and the direct concern for health issues that have the possibility to be

linked to lead toxicity highlight the lack of education and communication leading to low knowledge about lead and high emphasis on other areas on pediatric health.

Theme Two: Barriers Exist that Make Lead Toxicity Unrelatable

The second theme considers the barriers that surround the awareness of blood lead testing that make it unrelatable for most families, including lead toxicity's unknown or unrecognized risk, assuming that lead does not or will not affect one's family, lead as an invisible threat, and lead as a thing of the past. The unrelatedness that families describe feeling in regard to blood lead testing directly relate to the susceptibility and severity parents perceive elevated blood lead levels.

Lead is Out There, but Doesn't Affect Me. The first of the codes within this theme considers parents understanding that lead does exist, but it has no effect within their family. Interestingly, parents expressed tainted water as a source of lead. Frank describes, "I mean, I know there's a chance of lead in water and things like that, but I guess mostly just assume, surely you're going to filter it and take care of it." Florence explains that her currently living situation differs so greatly with her upbringing that she feels the water is of little concern. Florence states, "Yeah, I just, I know that, I don't know. I always grew up thinking the water here is better than the lake where water came from growing up, but just that was the first example that came to mind."

Lead is a Thing of the Past. Several parents expressed feelings that lead was a threat from the past. Parents described how we have generally overcome the threat of lead toxicity, how lead paint is particularly a threat from the past, and how and older or newer home's threat level is directly impacted by the date of construction. Few parents

described the potential for older toys, toys from other countries, or other items brought inside a home that could be a potential threat to their children.

Faith admitted that she felt the threat of lead is generally a threat of the past. She described this feeling, stating,

> "To me, I feel like it's something that was a problem in the past and we just kind of generalize and think of, it's, it's been solved. There's not a problem anymore. You hope that it's not been exposed to you. … if it's significant, then, then we need to not think that it's something that's past, because I really do view it as it's just something that we've dealt with and it's not a problem anymore."

Echoing Faith, Miriam expressed that lead toxicity is a threat related to the use of lead paint in the past. She explained, "I know that lead poisoning use to be like a big issue, like with lead being in most paints and whatnot."

Parents often commented on the age of their home and how it relates to the paint used and/or construction materials used. Parents who expressed concern because of their older home, quickly dismissed the concern. Fiona noted, "You always worry about, you know older homes, you know, we live in [an] older home, but we don't have any issues. … So that would be my biggest concern, older buildings." When asked about her family's particular risk for lead, Meagan answered, "I have always heard if you live in older houses, or things, it was a possibility for that, but that's pretty much the only thing I have heard." Morgan described her family's risk, commenting, "I would think relatively low [risk] outside of the fact that we do live in an older home."

Vivienne was one of very few parents who acknowledge the risk of other items brought into a home. She described her family's situation, stating, "We live in a newer home. So, like, my personal home, it's not something that I'm super concerned with, but

there may be items we have here that I'm not aware of that he could, you know, transmit it from."

Risk is Perceived as Little or Unknown. An overwhelming number of parents expressed lack of knowledge about lead, lead testing, or how lead may affect their children and children's overall health. Parents also expressed that the risk of elevated blood lead levels was either little, "minimal in my opinion," said one father, Frank, or unknown, "Yeah, I guess I kind of wonder, it's a rental house that he goes to [daycare], but the sitter is an at home sitter. So, I really don't, you know, know a lot about, about that house or, yeah, that's true," admitted Faith. Fiona detailed that, "I don't think my kids are at risk. At this point where we live, in particular, I don't know of any high risks that they would be having right now." Parents' low perceived risk of lead toxicity is one factor that hinders lead testing rates.

Marilyn, a mother of an almost one year older detailed her concerns, realizing that the threat may be more common than other parents realize. She described,

> "It is scary to think about, and especially since I have such a young child who's just now learning how to crawl, I noticed that she is like touching the wall more and we obviously have painted walls, but you know, she's touching the walls more and putting her hands on more things. Especially wanting to put her mouth on more things. So it is kind of scary to think about that, you know, it's probably more common that people think it is."

Lead is Invisible. As described in chapter one, lead is an invisible substance that is toxic when ingested or inhaled. While knowledge about lead is limited, parents do understand and express knowledge that lead is an invisible threat that may lead to symptoms that are invisible or difficult to link to elevated blood lead levels. Faith admits, "It could happen without me really knowing about it. … I thought they had to like, lick

the wall, and you would just know right away that there was a problem. But it sounds like you really wouldn't know."

Morgan expressed that the effects of lead may manifest as something she would not correlate with lead toxicity. She states, "And so I guess, like if he were exposed to lead like that, I wouldn't know it or that it might show up in ways that I might not be able to identify because it's not really like something that's top of my mind for me."

Theme Three: Communication Occurrence

The third theme concerns cues to action, including communication, and the lack thereof, that occurs within interpersonal relationships and other forms of communication. Parents either had strong expressions about the lack of communication regarding blood lead testing or vague remembrances of short conversations with pediatricians or their staff. Along with a strong sense of the lack of communication, parents also expressed a lack of cues to action in the form of physical materials present in the environment that would potentially remind or initiate a response to get their child's blood lead levels tested (such as posters or pamphlets).

Lack of Communication (With Providers and Others). Parents expressed a clear lack of communication with their child's provider about blood lead testing. One mother, Florence, confided, "[It's] just not brought up. If you don't ask it, it's not volunteered information. Another mother, Faith confessed, "I really don't think that we've had any conversations [with providers] about it."

Parents also described the lack of communication as a barrier to receiving potentially valuable and necessary information about their child's health. Frank, Florence's husband, articulated, "the only thing … that comes to mind isn't so much like

a physical barrier, or you know somebody has tried to stop you knowing this, but more so, nobody's informed us of it." Morgan, added to this point, stating, "I guess for me, my barrier to testing would be that I just probably wouldn't ask for it unless it were offered."

Lack of communication about lead in their day-to-day lives with friends and family was also acknowledged. Miriam explained that she and a friend often discuss health topics regarding their children. However, lead testing has never been a topic of discussion, she emphasized, "we've talked about a lot of other things, that [lead testing], she's never mentioned."

Without communication, Vivienne, a mother, regarded testing as "one of those things you really don't, you don't really think about." This suggests that more communication and greater interactions with materials about lead testing may increase a parent's awareness about blood lead testing for their child.

Lack of Physical Cues to Action. Similar to a lack of communication, parents expressed that there were no cues to action in their lives that prompt them to test their children for elevated blood lead levels. Cues to action exclude face-to-face communication about blood lead testing. These cues can include, but are not limited to, forms; pamphlets; television, print, or radio advertisements; posters displayed in provider offices or any other communication material that does not include direct, face-to-face conversation or communication. Morgan explained how the lack of communication, couple with the lack of cues to action make her feel, she states, "I guess like I just don't even know how to, or if he would be like an appropriate candidate for testing."

Another mother, Marilyn, remarked, "Honestly, no. I, it's never really been brought to my attention before now that there were tests for it. … But since she has had

so many checkups, I haven't heard once, or seen, like, any type of paperwork about it." Parents described pamphlets and informational handouts as something you receive concurrent with a medical test, vaccine, or other general growth information. Miriam revealed, "I get packets of information from my doctor, every checkup we go to … I don't recall reading anything about lead, being told anything about it or what to watch out for anything."

Parents express that the handouts are a cue to action that they appreciate. Meagan emphasized, "having some type of reading material that I could look at would be good."

When asked if she had ever noticed any patient materials, such as posters or flyers, about lead testing, Harriet, a mother of two bluntly added, "No. Never. Not around us. Not Indiana, no."

Cues to Action and Communication Do Occur. When blood lead testing is communicated to parents, it is often described as a "quick" conversation. Fred suggested, "You know, it's possible we had, you know, a quick one or two lines, you know, quick with it. But we, neither one of us recall it … If we had one it was not memorable."

Another parent Fiona, whose explicit remembrance of her children being testing for elevated blood lead levels puts her in a unique position, she recalls one of her children's appointment where the provider recommended blood lead testing, explaining, "We didn't really have a huge discussion on it, but they did say that…she got checked for lead. They mentioned it to me, and we went ahead and did it. I think it was at [the] four year [checkup]."

While Fiona described the communication between herself and the provider, Victoria recalls a 'cue to action' that could have been an opportunity for further

communication. Victoria remarked, “I don’t remember exactly, but I know that it was when we first set up our pediatrician, we had to fill out a survey questionnaire about, you know, they types of things, places that we live and like when our home was built, what kind of paint we had.”

Access to information was also an issue parents address, not only are providers not talking about lead testing, cues to action, such as posters or pamphlets, could not be recalled. When cues to action are present, parents are unable to recognize them and further, are unable to act on them due to a lack of communication and, as described in theme one, a lack of knowledge.

Theme Four: The Medical Field as a Reliable Source

The fourth and final code reflects the perceived understanding that the medical field is a trusted and reliable source of information. Parents regard doctors as a credible source of information, while also expressing that medical testing gives them “peace of mind.” While parents emphasize that the medical field is a trustworthy source of information, they correspondingly expressed frustrations with systematic barriers within the medical organization. Missing from the discussion was talk about other forms of information, particularly information found through social media or on the internet. Parents expressed seeing and looking at physical information at a provider’s office.

Doctors are a Credible Source of Information. Many parents indicated a feeling of confidence in their providers, regarding them as a credible, highly regarded, and trusted source of information. Florence described her children’s provider emphasizing, “We like our pediatrician, he’s nice, he’s straight forward. He’s very down to earth.”

Other parents disclosed that a provider's recommendation is the most influential recommendation they can receive, Marilyn offered,

> "I'm pretty much behind everything that the doctor says and suggests when it comes to that kind of stuff for that age group, just because being a first-time parent, you know, it's, this is all new to me. And obviously they know a lot more than I do, so I, I'm definitely open to their suggestions."

Vivienne reiterated this feeling, stating, "A lot of parents are very like very back and forth on like any type of test, any type of vaccine. And I'm the type, like the doctor says he needs it, he probably needs it." Another mother, Violet, commented, "If they think it's a good idea, we just go along with it and then, you know, do whatever they kind of recommend."

Without a provider's recommendation, parents revealed that blood lead testing would not be a priority to them. Hazel suggested that she would only proceed with blood lead testing "if it were recommended to me by my provider, I probably wouldn't push for it by myself." Meagan echoed her response, describing providers as a dependable source of information, stating, "I would probably want to hear it from our Pediatrician just to make sure its reliable."

Among all the characteristics that embody providers, parents described a sense of confidence in a provider's knowledge. Fiona reported, "I think that there is a feeling of confidence in your provider to give you up to date information." Current, broad, and deep understanding of medical testing is an important trait providers, especially pediatric providers must display to their patients. Violet described this, stating, "I think that's another thing where, you know, like doctors and pediatricians go to school for like these kinds of things… We do trust our pediatrician."

Medical Testing Gives me "Peace of Mind". Parents also responded that medical testing provides their family with a sense of peace and puts their minds at ease. Faith explained, "It just, giving you a reassurance that they don't have any issues." Fiona remarked, a bit stronger, "Why not? It's a poke. … If your worried about [it] then I think, there's not a lose-lose situation, it's a win-win, all it is, is a poke. … I mean you could stop this from happening. Intervene early you have less issues down the road."

Albeit a clear lack of knowledge described by parents in theme one, Victoria acknowledged a good reason for testing would be, "the awareness and having the knowledge, we are firm believers that knowledge is power. So, we are all for testing and things, I think the more we know we can, can know about our kids and their health, the better we can provide for them." Marilyn echoed Victoria's response, expressing, "I feel like a good reason to get her tested would just be … you never know … it's a subject that can be easily overlooked, but that doesn't mean that it doesn't happen."

Medical Organization Barriers. Multiple parents also expressed several barriers that occur within the organization of the medical field, specifically when it comes to medical testing. These barriers include the practicality of the test, scheduling appointments and the difficulty that can be, and financial barriers. One concern Fred had related to the legitimacy of the test, he questioned, "Is the test viable? Is it, you know, is it a legit test? All those types of things kind of play into decisions and thoughts and things like that."

Marilyn expressed apprehension about blood lead testing, revealing,

> "I guess if I had to think of a reason why I wouldn't feel confident about getting her tested is just the simple fact is like, you know, is it as necessary as some may think it is or some may say it is, you know, just cause it's not

> as commonly heard of, you know. But that's not to say that, that would make me not do it."

Mothers Victoria and Violet, respectively, reverberated each other, stating, "One of the biggest barriers is like [scheduling] appointments in a timely manner," and "I would kind of say [a barrier] would be scheduling an appointment. It's kind of hard."

One of the most recognizable barriers to testing is the financial burden on patients and their families. Along with potential out-of-pocket cost, insurance coverage for 'unnecessary' testing was of particular concern. Fred revealed, "You know, cost is always a big factor, you know, a big factor, especially when you get into, you know, what the insurance company covers, what they don't cover all of that good stuff." Vivienne added to this idea, disclosing, "Cost is another thing. So you know, if it's something insurance isn't gonna cover … those are probably the two main barriers … knowledge and money."

Harriett added that her child's provider disclosed that the "insurance company would not pay for that, unless there's a medical necessity."

In a notable response, Faith sums up the feelings of many parents, she described the challenges and barriers parents often face. She explained,

> "Insurance, that's a barrier. And sometimes a challenge. I guess, I guess just knowing what all the options and what all, all of the causes could be is whatever, you know, if you go for symptoms just you don't know really how to narrow it down, it's not your job. And then is the doctor actually going to narrow it down correctly and order the right tests?"

Summary of Chapter Four

Chapter four examined both the qualitative and quantitative data collected during this study. Overall parents expressed that when communication about lead did occur, conversations and cues were not memorable. A doctor's recommendation was noted in both the quantitative and qualitative data as being an important deciding factor for blood lead testing uptake. While there are barriers that make blood lead testing unrelated for parents, they express concerns for overall childhood health and a desire to do what is best for their children. Chapter five will delve deeper into the implications of these finding and more.

CHAPTER FIVE: DISCUSSION AND CONCLUSION

Chapter five will discuss the findings described in chapter four, the implications for these findings, the limitations of the current study, and will conclude with considerations for future research about blood lead testing communication.

With the understanding that low levels of lead testing within the state of Indiana are a topic of interest and problem worth researching, the current study aimed to better understand parents' perceptions regarding blood lead testing. Key concepts from the HBM guided the research questions, survey and interview questions, and how the data was analyzed. The model is a valuable tool that guides research about preventive health, screening behaviors, and illness control (Champion and Skinner, 2008). Blood lead testing is a combination of each of these three things. Despite this, the theory did not account for every finding, which will be discussed further in this chapter.

This research used both quantitative and qualitative methods to understand perspectives of susceptibility, severity, benefits, barriers, communication, cues to action, self-efficacy, and knowledge that Indiana parents have concerning their children and blood lead testing. Convenience and snowball sampling were used to recruit parent participants from four high-risk Indiana counties; Floyd, Hamilton, Marion, and Vanderburgh. As participants, parents were asked to complete a short online survey and then a telephone interview.

Chapter four highlighted the findings and themes that emerged from the qualitative data using thematic analysis and the quantitative data using Qualtrics and Microsoft Excel. The first research question in this study asked about perceived threat. These themes reveal that threat is perceived as low, and importantly, this low perceived

threat is mostly tied to lack of awareness and knowledge about elevated blood lead levels. To put it more clearly, this study revealed that parents generally do not know that lead toxicity is a potential threat to their children. The second research question asked about perceived benefits, perceived barriers, cues to action, and self-efficacy regarding lead testing. When asked, parents stated that understanding their child's overall health and having peace of mind was a benefit to lead testing. Barriers mostly included systemic medical organization barriers, such as difficulty scheduling appointments. Cues to action such as communication with providers, friends, and family was slim to non-existent. Cues to action such as physical pamphlets or posters were also seldomly discussed. However, parents did express clearly that if they were presented with the opportunity to get their child tested, they would. The following discussion section will further explore the theoretical and applied implications, potential directions for future research, and potential limitations of this project.

Discussion

This study aimed to examine Hoosier parent's perceptions of blood lead testing. Overall parents expressed a general lack of knowledge about blood lead testing and a lack of communication with providers about blood lead testing due to a variety of factors. Thematic analysis of the interview data and descriptive analysis of the survey data led to the discovery of four themes; discussion of each of these themes follows.

Parent Perceptions of Childhood Health

The first theme in chapter four acknowledges that parents are concerned with pediatric health. However, lack of knowledge and awareness about blood leading testing makes it a non-issue for many Hoosier parents. They did express clear concern for proper

nutrition and physical, mental, and neurological development as it relates to their child, but did not relate lead toxicity to developmental grown and progression in infant children (Mayo Clinic, 2019b). The medical field agrees that lead toxicity contributes to developmental delays in much of the same way as proper nutrition (AACAP, 2017; Mayo Clinic, 2019b, WHO, 2019). While future research will need to determine if knowledge leads to more awareness (or more awareness leads to more knowledge), both concepts contributed to parents' lack of focus on lead testing and lead toxicity in their children.

Knowledge

Lack of knowledge is an important theme presented in both the qualitative and quantitative data. The Chicago Lead Knowledge survey coupled with the interview responses from parents hint at a need and desire for education about blood lead testing. Lack of knowledge could potentially stem from the lack of communication about blood lead testing that occurs in the clinic setting and within interpersonal relationships. Downing-Matibag and Geisinger (2009) also found lack of knowledge as a major theme regarding sexual risk taking of college students. Students perceived oral intercourse risk to be extremely low comparing to risk of non-oral intercourse. This low perceived risk stemmed from a misunderstanding that the potential for sexually transmitted diseases or infections through oral sexual behavior is not as great as other forms of intercourse. Knowledge about sexual risk and lead testing are vastly different; however, both explore the use of preventative health behaviors (condom use and blood testing). Lack of knowledge, as seen in the Downing-Matibag and Geisinger article, could potentially stem from inadequate communication or total lack thereof. Miscommunication and/or inadequate communication could potentially downplay the seriousness of a disease or

illness. In the case of current study, parents who never learn about lead toxicity or lead testing could be more likely to not understand the potential risk their child is at for elevated blood lead levels.

Perhaps most important about knowledge, which is lumped together with other potential modifying factors within the HBM, is that it emerged as the strongest reason parents in this study do not engage in lead testing for their children. As such, one implication from this study is that educational campaigns around lead testing will be essential in addressing low lead testing rates. A 2014 systematic review found that education interventions were significantly and positively related to several health behaviors (de Melo Ghisi et al., 2014). Chew et al. (2002) found that television programs promoting health behavior change (exercise, weight loss, healthy eating, and smoking cessation) could increase health knowledge, which contributed to an increase in healthy behaviors. Carpenter's (2010) meta-analysis of the effectiveness of the HBM in predicting behaviors found that the strongest predictors were perceived benefits and perceived barriers. If parents do not know about the behavior, in this case blood lead testing, they will be unable to determine any benefits or barriers to the behavior. It simply may not cross their mind. For severity and susceptibility to play any role on behavior prediction, researchers and health campaign designers must first address that parents need to understand that lead and lead toxicity exist. In sum, knowledge and awareness precedes many of the other important variables in the HBM and must be addressed in future health communication work.

Lead Testing is not a Priority

The second subtheme in this theme found that parents do not prioritize lead testing. Parents were mainly concerned with other aspects of pediatric health, including all areas of development and a particular interest in nutrition. Research supports that nutrition is an important aspect of a child's overall health and development to both parents and providers (de Cunha & de Almeida, 2015; Glewwe et al., 2001; Ruel & Hoddinott, 2008). On the other hand, the connection between lead toxicity and developmental growth in children is also well understood and acknowledge by medical professionals and medical organizations of various levels (AACAP, 2017; Mayo Clinic, 2019b; WHO, 2019). Although many concerns were expressed, no parent connected potential developmental side effects of lead toxicity (e.g., decreased cognitive function, behavioral disorders, or slowed physical development, (ISDH, 2020)) to their preexisting nutritional or developmental concerns.

The findings from theme one are not without a silver lining. Once participants in this study were introduced to the topic of blood lead testing, they expressed a strong desire to want more information, but were unsure of how to access it or how to ask for it. Public health campaigns can help mediate this problem and potentially increase desired behavior (Wakefield et al., 2010). Educational materials and campaigns, both in the clinic and out in the public sphere, may help to increase knowledge about lead, leading to increased awareness and understanding of susceptibility and severity. Gettens and Drouin (2019) utilized a 5-part strategy to change New Hampshire's lead testing climate. Two important parts of this 5-part strategy were implementing an education program and creating and distributing medical "quick guides" reference materials. These strategies,

among others, contributed to a 19.4% increase in blood lead testing (Gettens & Drouin, 2019). A campaign in Maine used an educational strategy, which included partnerships within the community, brochures, mailing letters, PSA's, a website, trainings for public health nurses, displays and presentations, and newsletters to help increase blood lead testing throughout the state (Hubley & Amrich, 2006). This campaign resulted in a 20% increase in the number of blood lead test administer in the state of Maine compared to the year prior. These campaigns show the multifaceted nature of campaign work and give ideas for future lead testing campaigns in the state of Indiana, something that Hoosier parents would be receptive to, based on the findings in the current study

Barriers Exist that Make Lead Toxicity Unrelatable

In theme two, parents relayed that given what they *did* know about lead, they seldom thought of elevated blood lead levels, stating reasons such as lead toxicity being an unrelatable topic or not affecting their family, lead as a thing of the past, or little, no, or unknown risk of lead toxicity. Parents also described lead as invisible, both in terms of the physical substance and the signs and symptoms of toxicity. Vijayan (2009) considered how internal barriers, such as the fear of stigma of HIV, factored into pediatric healthcare. Through interview data, the researchers concluded that parents described their child's HIV status as something they never thought could happen. Pediatric health threats such as HIV may be vastly different than lead toxicity; however, parents may disregard these threats in a similar manor. In the current study, one parent recognized that their lack of knowledge about symptoms and severity of elevated lead levels would make it difficult for them to identify lead as the cause of symptom manifestation. Kegler et al. (2003) explored barriers to lead testing within an American

Indian community. Concurrent with the study presented here, parents expressed that they did not know about the need for blood lead testing. Similar to theme one, the findings of theme two are strongly related to knowledge about lead and lead testing. While each of these barriers are valid reasons parents are unsure of blood lead testing, lack of knowledge and communication about lead and how it presents itself in today's society appears to be a major contributing factor to parents not engaging in this behavior. Future research could be conducted to further examine how personal or internalized barriers, such as perceived risk or invisibility of disease/illness, affects parent's willingness to have their child tested for medical conditions.

Communication Occurrence

Theme three discussed the lack of communication occurring between parents and others, including both providers and friends and family, around lead and lead testing. The lack of cues to action around blood testing, particularly in the clinic setting, was also addressed. Parents expressed that if communication had occurred in the clinic setting with the provider, they would be more likely to engage in the behavior of blood lead testing. Increased communication and cues to action are necessary in order to change the landscape of lead testing in Indiana. There are two proposed avenues in which increased communication and opportunities for cues to action could potentially be achieved – campaigns within the community aimed at general education and focused efforts within a clinic setting aimed at increasing the frequency of patient-provider communication about lead toxicity and testing.

Community Campaigns about Lead Toxicity

Successful pediatric health campaigns have occurred in the past and include topics such as: Text4baby, a communication campaign about general infant knowledge (Whittaker et al., 2014); Head Smart, a bicycle helmet safety campaign (Bergman et al., 1990); and Back to Sleep, an infant sleep safety campaign (Havens & Zink, 1994; Pastore et al., 2003), among others. Both the Head Smart and Back to Sleep campaigns are preventative health behavior campaigns which aim to prevent head injuries and Sudden Infant Death Syndrome, or SIDS. Health campaigns have been proven as a useful tool in increasing a preventative health behavior, such as blood lead testing.

There have also been several successful local and state-wide campaigns aimed at increasing the behavior of lead testing infant children. As addressed in chapter one, Maine, New Hampshire, and Connecticut are a few states that utilized a multifaceted campaign approach (McLaughlin et al., 2004; Hubley & Amrich, 2006; and Gettens & Drouin, 2019). Each of these campaigns share an important common component – an educational element. These campaigns highlight the importance of mitigating the lack of knowledge through educational campaign efforts. The campaigns above used educational videos (McLaughlin et al., 2004), medical education programs and medical "quick guides" (Gettens & Drouin, 2019), and educational partnerships and community outreach measures, such as brochures, mailing campaigns, and presentations (Hubley & Amrich, 2006).

The campaigns discussed above call attention to the impact that medical handouts, in the forms of quick guides or brochures, can have on helping to increase blood lead testing. It is important to note; however, that Aldridge (2004) cautions researchers that

handouts alone are unlikely to change behavior or motivation, reminding us that behavior is multifactorial. In order to account for this, general public health campaigns could be used to increase Indiana parents' exposure to blood lead testing communication. Social media and the internet can also be useful tools to target specific audiences (Bernhardt & Felter, (2004); Fogel & Teng, 2016). Future campaign work within the state of Indiana should utilize research from other successful lead testing and lead education campaigns to design and implement campaigns aimed at Hoosier parents.

Promoting Clinical Communication about Lead Testing

Despite the fact that community education campaigns have shown success in other states, it is important to also focus on the communication that occurs in the clinic setting with providers. Lack of communication about lead testing between parents and providers is important because the American Medical Association and local health officials promote and advise testing for all children (Mayo Clinic, 2019a), and several parents in this study indicated that their providers never even brought up the topic of lead testing. While health communication campaigns in the public sphere can help raise awareness and educate people, providers play an essential role in actual uptake of the behavior. Future research could explore how providers could most effectively bring up conversations about preventative health screening, such as lead testing.

While all physicians must have a certain level of communicative intelligence to do their jobs, this ability becomes increasingly important among pediatricians because their communication with parents directly impacts children's health (Brown et al., 2007). Studies have shown that pediatric providers who complete mental health competencies or other trainings have better communication with parents about mental health (Brown et al.,

2013; CPACFH, 2009; Kemper et al., 2008; Wissow et al., 2008). While lead safely and mental health are very different health concerns, both present themselves in an often-invisible way to both providers and parents. If providers were obligated or encouraged to enroll in continuing education (CE) courses around blood lead testing and communication about this topic, parent satisfaction about preventative health screening communication could increase, as it did with mental health communication. Future research about communication satisfaction as it relates to provider training could be explored to better understand the level of communication parents expect or need in provider interactions.

The Medical Field as a Reliable Source

Theme four explored parent perceptions of the medical field, wherein parents perceived doctors as a credible source of information but have frustrations with barriers present in the clinical setting and healthcare in general. Overall, parents expressed concern with barriers to general healthcare maintenance, such as well-child visits where scheduling appointments, viability of medical testing, and financial considerations are challenges that hinder medical care. These frustrations are not new; a 1996 article discussing barriers and benefits of preventative health care services for children describes parents' frustrations with the medical system, stating reasons such as scheduling and transportation difficulties and long waiting times (Riportella-Muller et al., 1996). However, studies show that trust in medical providers, specifically doctors, exceeds trust in any other entity, including government health agencies and the internet (Hesse et al., 2005; Jackson et al., 2019). In terms of facilitators, or perceived benefits, to testing, parents responded that medical testing done by doctors gives them reassurance and

"peace of mind." Parents related knowing specific information about their child's health as having power. Throughout this study, knowledge, in all its forms, became a prominent theme. Messaging strategies from providers that incorporate the idea that blood lead testing will provide parents more knowledge about their child's overall well-being could be one avenue to explore.

Another particularly interesting insight is to consider the idea of using providers as spokespersons for community campaigns. As addressed in the finding for theme two, communication could and should be increase in two different settings – the public sphere and in the clinic. However, these campaigns and clinical efforts to increase knowledge, awareness, and communication about blood lead testing are not always mutually exclusive. Campaign designers could and should use this high trust in physicians to their advantage, partnering with community providers (Cohen et al., 2013) to better situate the campaign as legitimate.

Terminology

One final finding is worthy of discussion. Given the low knowledge and low awareness around blood lead levels and lead testing, there was special attention paid to the terminology used in this study. Kumar et al. (2010) found that many parents cannot understand common health information needed to care for infant children. This is consistent with a 2009 study that concluded that many U.S. parents have limited health-literacy skills (Yin et al., 2009).

For the current study, the ISDH specifically requested that the language used in this study and in any future work produced from this research include terminology that avoids phrases like "lead poisoning" and instead adopts language such as "lead toxicity"

or “elevated blood lead levels.” Scientifically, these phrases all mean the same thing, however, since health literacy varies for each individual, it is important to avoid language that parents may be unfamiliar with. When asked, all parents knew that “lead toxicity” meant the same as “lead poisoning,” while only half knew that “elevated blood lead levels” meant the same as “lead poisoning”.

It is important to assess how parents understand and use these terms when researchers, public health practitioners, and healthcare providers work to address knowledge and behavior in this context. Exclusively using the phrase “elevated blood lead levels” may mean not everyone in the target audience understands what the health message is referencing. Child and parent health literacy play an important role in predicting health behavior (DeWalt & Hink, 2009). On the other hand, using the phrase “lead toxicity” in exchange for “lead poisoning” was familiar and understood by parents. In addition, using consistent messaging is important. Elek et al. (2013) discussed participants’ desire for “medical providers to present more consistent messages to their patients” (p. 1870). In sum, assessing specific health literacy and preferred (or known) terminology as it relates to blood lead testing in a more nuanced way is a worthy topic for future research in health communication, but this study suggests the use of well understood terminology is one small step researchers and practitioners can take to better reach parents.

Limitations

Like any research study, this one has important limitations to consider. Limitations of this study include potential personal bias, recruitment issues, lack of more complex survey measurements, considerations of literacy, and more. At this point, I

would like to remind readers to please read Appendix A, which outlines the changes that were made due to the onset of coronavirus disease 2019. The limitations below are for the current study only and do not consider the changes that were made due to the global COVID-19 pandemic.

Limitations Related to Potential Personal Bias and Role in Research

I want to start by acknowledging the potential for my own personal bias and limitations as a researcher to have seeped into the research process. I chose the research methods, decided on the questions to ask, and interpreted the qualitative data. While I do have training in survey design and interviewing methods, and I have read extensively other health communication research employing similar methods, it is possible that my limited experience with research led me to not conduct the study in the most rigorous or complete way. In addition, I am not a parent myself, and therefore I may lack a full understanding of what these parent participants shared with me about their perceptions of caring for their child. For example, one of the most challenging aspects of interviewing parents was gauging their potential psychological distress at discussing a potential health threat to their child. I did try to combat this by listening to tone of voice; however, conducting the interviews via Zoom or other videoconferencing applications could have further helped me to understand potential signs of distress. These two limitations were addressed by relying on expert sources on blood lead testing (e.g., reading scholarly and public health work on the topic, consulting with the ISDH lead office) and working with my advisor and committee to receive guidance on conducting the research procedures.

Limitations Related to Recruitment and Representativeness

Using convenience and snowball sampling, this study investigated the research questions as a formative research study. The intended purpose was not to represent all Hoosier parents or all parents from each of the four Indiana Counties. This data collected here focused on perceptions from a small group of parents with young children from high risk counties. Recruitment for this study happened mainly online using social media, specifically Facebook. There are several limitations to consider regarding recruitment. Recruitment online using my personal social media was only able to spread so far, and even with post-sharing from friends and family, recruitment numbers were low. Hamilton County participation was exceptionally low, with only two parent participants, and the highest, Marion County, still only resulted in five parent participants. As such, these findings are not generalizable for all parents in any of the four counties. Recruitment also lacked representativeness in terms of demographics. Thirteen of the 14 parents self-identified as Caucasian, and the only minority represented was Asian. African American persons account for approximately 10% of Indiana's population (U.S Census Bureau, 2018), and accounts for approximately 30% of Marion county's population, U.S Census Bureau, 2018). While attempts were made to target Black and other racial minority parents, these attempts were unsuccessful. I also did not assess or attempt to recruit based on other important demographics. While this study did recruit parents from areas where lead testing is low and risks are high and therefore identified important parent perceptions regarding these two issues, future work should attempt to recruit from more diverse parent backgrounds.

In addition to not assessing a number of sociodemographic variables, there are several limitations regarding the questions that were not asked in either the online survey nor the telephone interview. Level of education and household income are two commonly asked questions that were not included. These questions were not left out for any particular reason, but if asked, would have been an indication of the socioeconomic status of the household these children are raised in. Other questions, such as asking marital status, do not do enough to explain any phenomenon about blood lead testing. A question about the number of children the parent has and their ages would have been helpful in facilitating conversation during the interview process and how blood lead testing may have potentially changed for different children in the same family. Some parents did disclose their other children and talked about them together, rather than focusing on one of their particular children. Other parents disclosed having an older child, but questions about that child's blood lead testing were not asked. Future work should work to not only recruit, but ask about, these other important participant characteristics.

Limitations Related to Survey and Interview Questions

Since knowledge, awareness, and navigating the healthcare system all emerged as important findings, one measure that could have been included in the survey is a health literacy scale. Along with level of education (described above), understanding parents' health literacy may have helped further define how the counties differed, how Hoosier parents compare to the national average, or could have been useful to compare health literacy score with Chicago Lead Knowledge scores for a potentially interesting correlation analysis. Future studies about parent's perceptions of pediatric health should include a health literacy scale.

Limitations Related to Survey and Interview Format

Due to the changes made in the study due to COVID-19, parents were only able to participate in the study if they had access to a telephone and/or the internet. Parents also only really heard about the study through the use of social media (or through known mutual contacts). Parents who did not use Facebook and who did not have access to a telephone or the internet were not fairly represented in the study. The exclusive use of these technologies, which not only illuminate issues of access (e.g., digital divide) but also skills and comfort (e.g., technology and computer literacy) in recruitment and completion of this study may have biased my sample in a number of ways. Future research could be conducted with parents using other recruitment tactics and in-person interviews to see if data is different than that of this study.

Limitations Related to Self-Reporting of Lead Testing

Some parents expressed difficulty in remembering if blood lead testing had occurred or not. Since blood lead testing is not a memorable test for many parents and comes at a time in a child's life when numerous tests are being offered, self-reporting numbers of lead testing should be read with caution. Future work could address this by obtaining access to medical records or conducting research in a clinic setting during time of potential lead testing.

Conclusion

This study investigated Indiana parents' perceptions about blood lead testing using the HBM as a guide. The findings from this study yielded broad suggestions for future work within the field of communication research and specific suggestions for applied communication campaign research and clinical interventions within the state of

Indiana. This study suggests we still have a long way to go as a state in addressing the dangers of lead toxicity and increasing regular testing among Hoosier children.

Benjamin Franklin implored young Benjamin Vaughn to concern himself with the "mischievous effects of lead," Franklin was right then, and he is right now. We must continue to concern ourselves with lead levels, and health communication can play an important role in how we do this. This study identified important constructs related to parents' perceptions of lead testing of their children. Hoosier parents expressed a desire for information and future education about blood lead testing, especially in a clinical setting. A starting point for all future campaign work must be educational in nature. Before we can convince parents that blood lead toxicity is severe or their child is susceptible, they must first understand that it exists. As such this current study can serve as a starting point to inform future lead testing communication interventions and messaging in Indiana, so that no child must suffer the consequences of lead toxicity.

APPENDICES

Appendix A: Original Plans

Prior to the global pandemic, COVID-19, I had planned a two-part study which would evaluate both parent and provider perceptions of lead testing throughout the state. The original proposal included face-to-face or telephone interviews with providers and face-to-face focus groups with parents from four counties in Indiana. While social distancing and quarantining became the new normal, the research plan changed. Provider interviews have been delayed for future research and the face-to-face parent focus groups were redesigned to be held as one-on-one telephone interviews. While I understand the loss of a potentially "rich" data set that would have resulted from the focus groups, the data collected from the telephone interviews allowed each parent to fully answer each question, spending as little, or as much time as needed to complete their unique answers. While participants were unable to build upon each other, as the interviewer, I was able to sum up answers from the collective participant pool when discussing questions with individual participants. For instance, saying phrases such as, "many parents have also said similar things about how they feel uneducated" or "I have heard that answer so many times! You are definitely not in the minority; can you delve into that a little deeper?" Building strong rapport with each participant provided an environment for rich data to thrive.

Chapter three includes the methods for county selection, participant criteria and recruitment, and the protocol that guided this project.

Appendix B: Social Media Post

Dear Facebook Friends, please help me recruit for an important study concerning the communication and perceptions parent and providers have regarding lead testing for infant children. This project is seeking both parents and pediatric providers (medical doctors, nurse practitioners, and physicians' assistants) currently living and/or practicing in Floyd, Hamilton, Marion, or Vanderburgh, Indiana counties. Please see the eligibility requirement for each group below:

Eligible parent participants for this study must:

- Live in Floyd, Hamilton, Marion, or Vanderburgh, Indiana counties;
- Have at least one child five (5) years of age or younger;
- Must have a primary care provider that the child sees regularly for well-child visits;
- Speak and read English;
- Have internet access for surveys;
- Have access to a phone for interviews;
- Agree to complete an online survey;
- Agree to participate in a telephone interview lasting up to 30 minutes.

Eligible provider participants for this study must:

- Practice in Floyd, Hamilton, Marion, or Vanderburgh, Indiana counties;
- Currently practice in a primary care setting;
- Have the authority or decision-making ability to order a blood lead test;
- Speak and read English;
- Have access to a phone for interviews;
- Agree to a telephone interview lasting no more than 30 minutes.

All participants will be compensated for their time with a $20 gift card.

This study is directed by me and Dr. Katharine Head at IUPUI. It is approved by the Indiana University Institutional Review Board, and accordingly all information will be held in strict confidence. Participants in this study will not be identified.

If you have interest in enrolling in or learning more about this study, please contact Katie Kruer, by either sending a direct Facebook message, emailing to _____, or calling __-___-____.

If you know of someone else who may be interested in or eligible for this study, please forward this request to them.

Appendix C: Email Correspondence

Email One (Confirmation of Eligibility):

Hello!

My name is _____ and I'm part of a study being led by Dr. _____ from the Department of Communication Studies at IUPUI. We are conducting a study to evaluate how parents know about lead testing, and the perceptions of severity, susceptibility, barriers, and facilitators that parents express in regard to blood lead testing. This project is being supported by Indiana University Purdue University Indianapolis. This study is being conducted with eight provider and up to 40 parents throughout the state of Indiana. Parents are asked to complete both an online survey and a telephone interview for this study.

You have reached out to us expressing interesting to participate in this study. First, thank you! Second, we want to ensure that you meet all of the eligibility requirements for this study before continuing with the survey potion of your participation. Please look over the eligibility requirements listed below and affirm that you meet these criteria.

- Live in Floyd, Hamilton, Marion, or Vanderburgh, Indiana counties;
- Have at least one child five (5) years of age or younger;
- Must have a primary care provider that the child sees regularly for well-child visits;
- Speak and read English;
- Have internet and phone access;
- Agree to complete an online survey;
- Agree to participate in a telephone interview lasting up to 30 minutes.

Please respond to this email confirming your eligibility and let me know which county you are from. From there, we will send you a link to complete the short survey as well as an information sheet, which you can review before agreeing to participate.

I look forward to hearing from you!

Sincerely,

Email Two (Invitation to Survey and Participant ID):

Hello!

Thank you for confirming your eligibility for this study.

First, please complete this short survey, provided below is the link. You will be asked to enter a participant ID number. Here is your unique participant ID number, **XXXXX**, which is to be copied and pasted into that box. Attached in this email is a study information sheet, please review it before completing the short survey and let me know if you have any questions.

Participant ID: _____

https://iu.co1.qualtrics.com/jfe/form/SV_3VFo8LRGRMEdcdT

Second, below are several interviews days and times that work for me, please select one or let me know if none of these work for you. I am very flexible, and we can find a time that best suits your needs!

Date and Time

Date and Time

Date and Time

Date and Time

If you have any questions or would prefer to discuss interview scheduling over the phone, please call me at (XXX)-XXX-XXXX.

Thank you,

Attached: Information Sheet

Appendix D: Online Survey

Demographics:
1. What is your race?
a. White
b. Black or African American
c. Asian
d. Native Hawaiian or other Pacific Islander
e. American Indian or Alaska Native
f. Other: _____.
2. What is your marital status?
a. Married
b. Divorced
c. Widowed
d. Separated
e. Never married
f. Member of unmarried couple
3. What is your age in years?
a. Please specify: __ years
4. How old is your child(ren)?
a. _____
5. When your child was 6 – 36 months of age, where did you live? (City, State)
a. _____
6. What county do you reside in?
a. Hamilton
b. Floyd
c. Marion
d. Vanderburgh
General Terminology Questions:
1. Which of the following phrases has the same meaning as "lead poisoning?" Select all that apply. *(Correct answers are bolded.)*
a. Lead Toxicity
b. Lead Poisoning
c. Heavy Blood
d. Elevated Blood Lead Levels
e. Metal Clotting Disorder
f. Elevated Hemoglobin Levels
Health Belief Model Questions:
1. Did your child's health care provider test your child's blood level between the ages of 6 and 36 months?
a. If yes, select all the reasons your family tested for elevated blood lead levels.
i. My child is/was exposed and susceptible to lead.

ii. Elevated blood lead levels have dangerous and severe symptoms.
iii. I understood the benefits.
iv. I had easy access to the test.
v. It came at my child's doctor's recommendation.
vi. I felt like I could make an informed decision and felt confident in my decision.
vii. Other: (fill in the blank)
b. If no, select all the reasons your family did not test for elevated blood lead levels.
i. I did not think that my child is/was not exposed or susceptible to lead.
ii. Elevated blood lead levels are not dangerous. I don't think elevated levels are severe enough to harm my child.
iii. I did not understand any possible benefit.
iv. I had inadequate access to the test.
v. My child's doctor never recommended the test.
vi. I felt like I did not know enough about the test to have it performed.
vii. I did not have custody of my child when they were 6 – 36 months in age.
viii. Other: (fill in the blank)
Chicago Lead Knowledge Test
1. Lead paint chips can be poisonous when eaten.
a. True
2. High lead in the body can affect a child's ability to learn.
a. True
3. Most children have symptoms right away if they have an elevated blood lead level.
a. False
4. Apartment owners are required to tell renters about known lead-containing paint in the apartment when a lease is signed.
a. True
5. A child's highest blood lead level generally occurs around 5 years of age.
a. False
6. Lead paint is more likely to be found in newer home than in older homes.
a. False
7. Living in a building during renovation/remolding can increase a child's exposure to lead.
a. Ture
8. One way for children to get lead poisoned is by having lead dust on their hands and then putting their hands in their mouth.
a. True
9. A child can become lead poisoned during exposure to lead-containing dust.

a. True
10. Some pottery imported from Mexico or other countries is not safe to use in cooking or for eating because it contains lead.
a. True
11. Parents who work with lead at their jobs can bring lead home on their clothes.
a. True
12. The lead a pregnant woman takes into her body can be transferred to the unborn baby.
a. True
13. Lead in soil cannot harm children.
a. False
14. Most cases of childhood lead poisoning are caused by drinking water that contains lead.
a. False
15. Most children get lead posing by breathing lead rather than by eating or swallowing lead.
a. False
16. Some herbal or traditional home remedies contain lead.
a. True
17. Washing a child's hands often helps prevent lead poisoning.
a. True
18. Warm tap water usually contains less lead than cold tap water.
a. False
19. Lead in water can be removed by boiling.
a. False
20. Cleaning a home with soap and water decreases the lead in the home more than dusting or sweeping.
a. True
21. The human body needs a small amount of lead for good nutrition.
a. False
22. Less lead is taken up by the body if the child eats a balanced diet, without too many fatty foods.
a. True
23. A diet with a good amount of iron-containing food will help decrease a child's chance of becoming lead poisoned.
a. True
24. A diet with enough calcium helps prevent lead poisoning.
a. True

Appendix E: Interview Guide

Parent Interview (Telephone Call)
Hello!

This is Katie Kruer.

Hi! Thank you so much for reaching out and agreeing to participate in this survey. Before we begin, I would like to take just a moment to review the study again with you, this information should be a review from the email and study info sheet you have already received.

Again, my name is Katie and I'm part of a study being led by Dr. Katharine Head from the Department of Communication Studies at IUPUI. We are conducting a study to evaluate what parents know about lead testing, and the perceptions of severity, susceptibility, barriers, and facilitators that parents express in regard to blood lead testing. This project is being supported by Indiana University Purdue University Indianapolis and is being conducted with eight providers and up to 40 parents throughout the state of Indiana.

For this interview, I am going to specifically, ask you about why you have or have not had your child's blood lead levels tested, what might prompt you to do so, what messages you see or hear about lead testing, and your personal beliefs on the importance of blood lead testing. We will not collect any identifying information about you or your child. Instead, we are only interested in your general communication practices. We will record your verbal answers on a computer questionnaire; and your answers will be combined with answers from other parents. You can choose to not answer any question at any time. At the conclusion of the study, we would like to send you a digital $20 gift

card as a thank you for your time and participation. You should know that you can drop out at any time without any negative consequences.

Are you okay with continuing with the telephone interview?

Perfect! Before we begin, can you please tell me your participant ID?

Great, thank you. Alright, to begin the interview process, I want to take a step back and talk a bit about what are the biggest health concerns you have for your child?

…. In particular, for children ages 6 months to 36 months, what are the biggest health risks that you hear about or remember hearing about/being concerned about?

Thank you for talking about these general concerns. It helps to understand what health concerns are at the forefront of parents' minds.

Questions for all Parent Interviews	
I.	**General**
A.	As you know, today's interview is about one particular health risk – elevated blood lead levels. What do you know already about blood lead levels and how they may relate to your child?
B.	Prior to this interview, you completed a knowledge survey about lead testing. What information did you learn that has had the biggest impact on you, so far?
C.	What part of this survey was particularly surprising, scary, or reinforced already known suspicions or assumptions you had about lead?
II.	**Susceptibility**
A.	Describe the risk you believe your child has for an elevated blood lead level.
B.	What particular concerns do you have about this risk?
III.	**Severity**
A.	If your child had elevated blood lead levels, what do you believe the symptoms would be?
B.	How severe do you believe the side effects would be?
IV.	**Benefits**
A.	How might blood lead testing benefit your child or your family?
B.	What would you consider good reasons to get your child lead tested?
V.	**Barriers**

	A. Describe any barriers you have seen or noticed when thinking about testing for medical concerns, such as lead testing.
	B. Describe the conversations you recall about blood lead testing with your child's provider(s)?
VI.	**Cues to Action**
	A. What are some things that might motivate you to get your child blood lead tested?
	B. Have you ever observed or experienced anything that makes you consider getting your child tested? Describe these instances.
	C. What outside advertisements or patient materials have you seen about blood lead testing for your child?
	D. How do other parents you know talk about blood lead testing?
VII.	**Self-Efficacy**
	A. Describe how you feel about blood lead testing and how it relates to your child.
	B. Why do or why don't you feel confident about getting your child blood lead tested?
VIII.	**Conclusion**
	A. In your day-to-day life, where would you want to hear information about blood lead testing?
	B. What should this information look like?
	C. As a parent what is/are the most important aspect(s) of this message?

Well, that concludes our interview process. I want to once again thank you so much for your participation. The gift cards are processed through our school office, and with the COVID stuff going on, it may take several days for you to receive the digital gift card. Please email me if you do not receive the gift card within a week.

Also, if you know of anyone living in either Hamilton, Marion, or Vanderburgh (which in Evansville) counties, I would love if you could share my information with them.

Once again, thank you so much for participating! Good-bye!

Appendix F: Debriefing Material

Debriefing Material sent via Email with message below:

Thank you for taking part in this study. This project is being conducted to better understand and assess the knowledge and awareness that Hoosier parents have about blood lead testing, where parents would like to see lead testing message, and what theses message should include.

If you would like further information about the study or would like to know about what my findings are when all the data have been collected and analyzed, then please contact me at _____. I cannot; however, provide you with your individual results.

If taking part in this study has raised any specific concerns about blood lead testing, please look at the CDC handout provided in the proceeding pages and/or visit the CDC's website, provided below, which includes information about lead toxicity prevention, local and state programs, and frequently asked questions regarding lead. You may also bring concerns about blood lead testing to your local health department or pediatric provider.

https://www.cdc.gov/nceh/lead/prevention/default.htm

Prevent Childhood Lead Poisoning

Exposure to lead can seriously harm a child's health.

Damage to the brain and nervous system

Slowed growth and development

Learning and behavior problems

Hearing and speech problems

This can cause:

- Lower IQ
- Decreased ability to pay attention
- Underperformance in school

Lead can be found throughout a child's environment.

1. Homes built before 1978 (when lead-based paints were banned) probably contain lead-based paint.

When the paint peels and cracks, it makes lead dust. Children can be poisoned when they swallow or breathe in lead dust.

2. Certain water pipes may contain lead.

3. Lead can be found in some products such as toys and toy jewelry.

4. Lead is sometimes in candies imported from other countries or traditional home remedies.

5. Certain jobs and hobbies involve working with lead-based products, like stain glass work, and may cause parents to bring lead into the home.

The Impact

535,000

U. S. children ages 1 to 5 years have blood lead levels high enough to damage their health.

24 MILLION

homes in the U.S. contain deteriorated lead-based paint and elevated levels of lead-contaminated house dust.

4 MILLION of these are home to young children.

It can cost

$5,600

in medical and special education costs for each seriously lead-poisoned child.

The good news:
Lead poisoning is 100% preventable.

Take these steps to make your home lead-safe.

Talk with your child's doctor about a simple blood lead test. If you are pregnant or nursing, talk with your doctor about exposure to sources of lead.

Talk with your local health department about **testing paint and dust in your home for lead** if you live in a home built before 1978.

Renovate safely. Common renovation activities (like sanding, cutting, replacing windows, and more) can create hazardous lead dust. If you're planning renovations, use contractors certified by the Environmental Protection Agency (visit www.epa.gov/lead for information).

Remove recalled toys and toy jewelry from children and discard as appropriate. Stay up-to-date on current recalls by visiting the Consumer Product Safety Commission's website: www.cpsc.gov.

CDC

Visit www.cdc.gov/nceh/lead to learn more.

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CURRICULUM VITAE

Kaitlyn Hannah Kruer

Education

- M.A. in Applied Communication, Indiana University degree earned at Indiana University-Purdue University Indianapolis. December 2020.
- B.A. in Communication Studies, Indiana University degree earned at Indiana University-Purdue University Indianapolis. May 2018.

Awards

- *Burns/Wagener Scholarship in Communication Studies*, outstanding undergraduate scholar award, April 12, 2018.
- *Lambda Pi Eta*, inducted member: Spring 2018, Honors Society of the National Communication Association.
- *Outstanding Professor across the Campus*, honored by IUPUI Athletics, 2019.
- *The Masters Academic Achievement Award in Communication Studies*, highest Masters level honor for outstanding scholarship and overall academic excellence within the IUPUI Department of Communication Studies, April 23, 2020.

Professional Development

- "Associate Faculty Teaching Forum" workshop presented by Indiana University-Purdue University Indianapolis's Center for Teaching and Learning, September 2019.
- Teaching@IUPUI: Promoting Active Learning in Your Classroom: Online Wevinar, Center for Teaching and Learning, Indiana University-Purdue University Indianapolis, September 25, 2019.

- "IUPUI Liberal Arts Faculty Workshop: Workshop on Teaching Online at IU" presented by the Office of Online Education, February 7, 2020.

Research Publications and Presentations

Peer-reviewed Journal Articles

Scott, S. F., Head, K. J., Johnson, N. L., **Kruer, K.**, & Zimet, G. D. Communicating HPV test results: A directed content analysis of women's preferences utilizing self-determination theory. Paper under review at Journal of Applied Communication Research.

Competitively Submitting Conference Presentation

Scott, S. F., Head, K. J., Johnson, N. L., **Kruer, K.**, & Zimet, G. D. Communicating HPV test results: A directed content analysis of women's preferences utilizing self-determination theory. Paper accepted for presentation at the National Communication Association 2019 convention (Baltimore, MD).

Service

Department

- Panel Member, "Beyond the B.A.", Indiana University-Purdue University Indianapolis, January 22, 2019.
- Paper reviewer, "Undergraduate Outstanding Paper/Project Awards", Department of Communication Studies, Indiana University-Purdue University Indianapolis, April 12, 2019.
- Graduate Student Volunteer/Host, Taylor Symposium, Indiana University-Purdue University Indianapolis, February 20, 2019.

- Paper reviewer, “Undergraduate Outstanding Paper/Project Awards”, Department of Communication Studies, Indiana University-Purdue University Indianapolis, April 23, 2020.
- Graduate Communication Club, Vice President, Indiana University-Purdue University Indianapolis, June 2019 – May 2020.

University

- Donor Escort, Komen Tissue Bank Tissue Collection Event, IU Simon Cancer Center, Indianapolis, IN, April 13, 2019.
- Donor Escort, Komen Tissue Bank Tissue Collection Event, IU Simon Cancer Center, Indianapolis, IN, November 16, 2020.